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# MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

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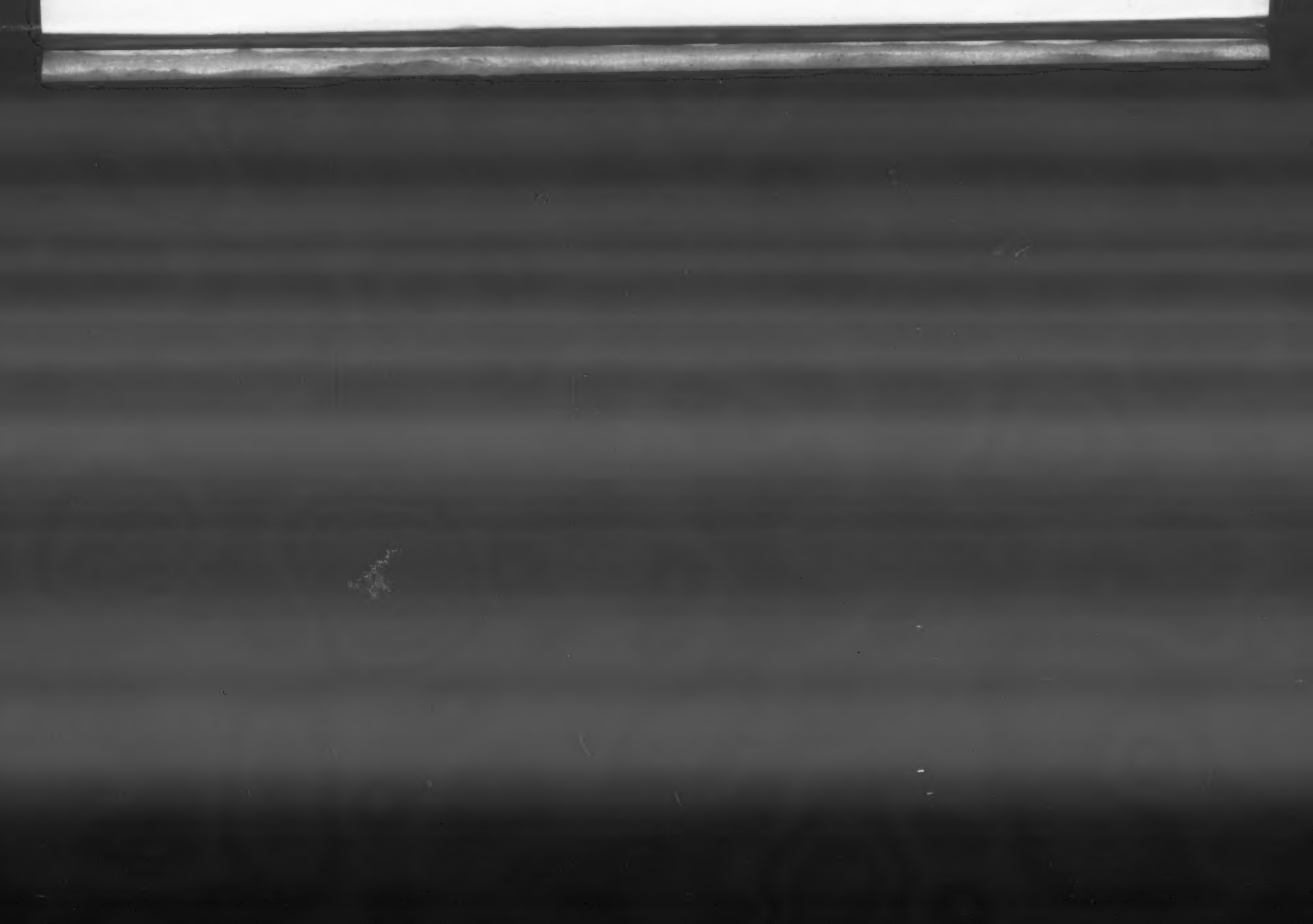

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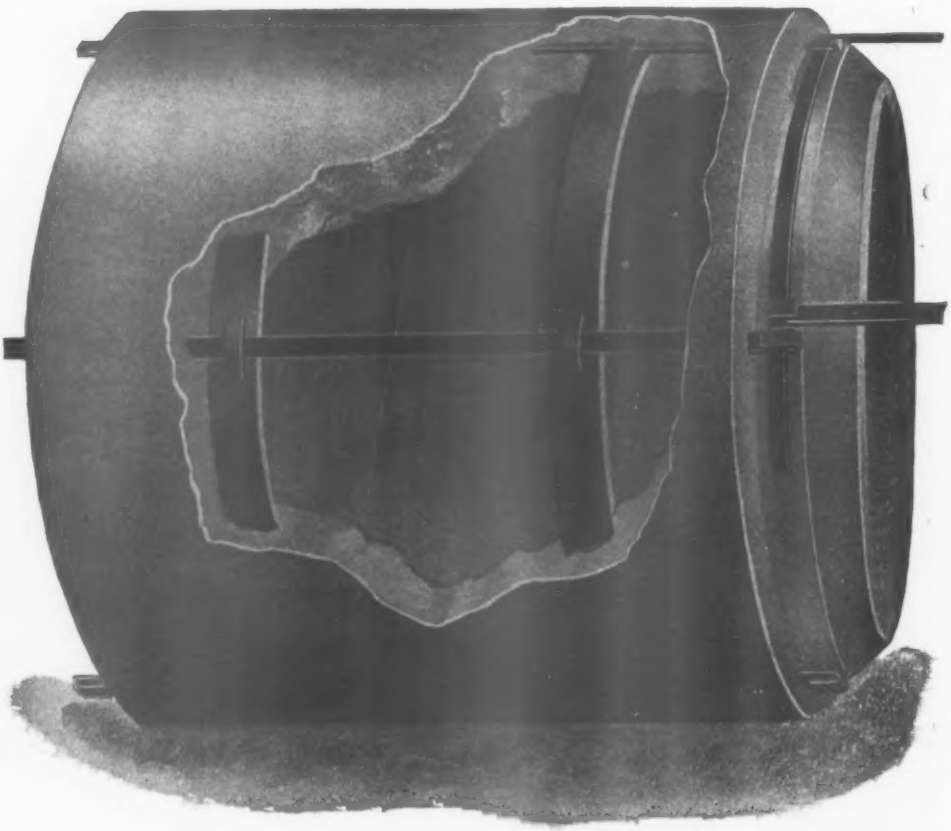

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# MUNICIPAL ENGINEERING

VOLUME XXXV. JULY, NINETEEN HUNDRED EIGHT. NUMBER ONE.

## CLAY IN MORTAR AND ITS EFFECTS.

THE inquiry of a correspondent for information concerning the effect of clay upon strength, time of setting and permeability of mortar is answered in the Question Department so far as the collection of data in the volumes of MUNICIPAL ENGINEERING is concerned, and suggests a discussion of the present state of knowledge and theory upon the subject.

The articles referred to in the answer to the question give the results of various tests and experiments, and one of them states a theory of the action of clay and loam in increasing the strength of cement. This theory, first stated by C. C. Huestis, is that a certain percentage of fine material is needed to fill the voids in the mortar, some of it finer than the finest dust found in sand in appreciable quantities, and this fine material may be supplied by using a large proportion of cement or by using very finely divided material of some other nature. The latter course produces a cheaper concrete because a cheaper material may be substituted for a part of the cement. It also increases the strength on the theory, frequently stated by S. B. Newberry, that the strongest concrete is that in which the voids are least and the cement used is only sufficient in amount to insure the filling of all the voids.

E. S. Clarke reports in a paper before the American Society of Civil Engineers, printed in vol. xiv of the transactions of the society, that 10 per cent. of loam in Rosendale cement mortar did not decrease the strength after six months and one year. Portland cement mortar was not weakened by clay in moderate quantities, nor were its weathering qualities impaired in two and a half years.

Some experiments made at the University of Kansas in 1904 showed increase in strength of concrete at 28 and 90 days of age of briquets for various mixtures of clay up to 15 per cent., a 20 per cent. mixture showing a slight reduction in strength below the mortar without clay. The increase was more than 100 pounds, 20 per cent., for 4 and 6 per cent. of clay, 1 to 3 mortar; 2, 10 and 15 per cent. mixtures showing less increase in strength.

Following are some results of tests made by U. S. engineers in 1904, which have not heretofore been published except in the report of the Chief of Engineers, U. S. Army:

STRENGTH OF MORTARS OF SAND AND LOAM OR CLAY.

Each result is the average of two briquettes. The results are stated in pounds per square inch of tensile strength, and the proportion of sand to cement is 3 to 1, the clay or loam displacing the portions of the sand stated.

| | 7 da. | 28 da. | 3 mo. | 6 mo. |
|---|---|---|---|---|
| Sand and cement.. | 208.5 | 326.5 | 339. | 342.5 |
| 5 per cent. clay.. | 219. | 349.5 | 335.5 | 337. |
| 10 per cent. clay.. | 211.5 | 325.5 | 332.5 | 330.5 |
| 15 per cent. clay.. | 204. | 298.5 | 265. | 222.5 |
| 20 per cent. clay.. | 186.5 | 264.5 | 254. | 208. |
| 25 per cent. clay.. | 169. | 245.5 | 223. | 167.5 |
| 5 per cent. loam.. | 204.5 | 363. | 315. | 318. |
| 10 per cent. loam.. | 203.5 | 367. | 324.5 | 330.5 |
| 15 per cent. loam.. | 203.5 | 366.5 | 324.5 | 317. |
| 20 per cent. loam.. | 218. | 371. | 245.5 | 227.5 |
| 25 per cent. loam.. | 219.5 | 374. | 243.5 | 219.9 |
| 30 per cent. loam.. | 222.5 | 355.5 | 253. | 213. |
| 35 per cent. loam.. | 201.5 | 303. | 243.5 | 216. |
| 40 per cent. loam.. | 193.5 | 284.5 | 236. | 205.5 |

In this table it will be observed that the results obtained by using loam are quite as favorable as those obtained by using clay. Higher percentages of loam than clay can be used, as shown by the table and a note thereto in the original, which states that the clay acted so unsatisfactorily during the working of the 25 per cent. batch that no more briquettes were made with clay, although the experiments with loam were continued up to 40 per cent.

The clay used was taken from the cutter of a dredge working in Galveston channel and the loam was heavy black soil from the mainland. Both

were thoroughly pulverized, were apparently free from vegetable matter and sand and were sifted to remove lumps. There is no information as to whether the clay was colloidal or not, but doubtless the loam was not entirely so.

The soil used in the Galveston experiment is probably much better than that used by Mr. Hain in his experiments, for the results are much more uniform and are proportionately higher. Mr. Hain states that the soil he used contained much organic matter.

There has been some recent discussion of this subject, apparently started by the report of Richard H. Gaines, chemist of the New York City board of water supply, of the results of experiments on mortars containing various proportions of clay, made in his discussion of a paper on laws of proportioning concrete, presented to the American Society of Civil Engineers. Mr. Gaines evolved an application to the process of rendering concrete impervious of the electrolytic theory of chemical action based on the ionic hypothesis, and made a number of experiments to show the soundness of the theory. He concludes from the experiments that water-tight concrete can be made by replacing the mixing water with a 1 to 2 per cent. solution of a suitable electrolyte, i. e., a suitable salt; by substituting dry and finely ground colloidal clay for 5 to 10 per cent. of the cement and mixing the two together thoroughly; or by the use of both. His table shows with reference to the use of the electrolyte, a solution of alum, that the permeability reduces almost to zero with increase in strength of solution to 5 per cent., and an increase in strength up to 2½ per cent. solution and a decrease for greater strength of solution. The addition of colloidal clay shows reduction in permeability to zero and material increase in strength for 5 and 10 per cent. of clay. The use of both produces similar results. Thus at 28 days age of briquets the compressive strength of 1 to 3 mortar was 1,635 pounds per square inch; the substitution of 5 per cent of clay in the cement increased the strength to 2,390 pounds and the addition of 10 per cent. of clay increased it to 2,350 pounds. Tensile strength was increased from 205 pounds without clay to 258 and 335 pounds with 5 and 10 per cent. respectively.

In a paper before the National Association of Cement Users James L. Davis, in charge of the laboratory of the board of water supply, gives further detail of results with alum sulphate, clay and hydrated lime, which are of the same general character.

The theory advanced by Mr. Huestis to explain the increase in strength for additions of fine foreign matter up to a certain percentage and the decrease beyond that proportion is based on a purely mechanical principle, and all that is necessary is to mix the cement and the aggregate together thoroughly so that every particle, large and small, shall have its coating of cement when the final wet mixture is completed. It is more difficult and expensive to do this by drying and pulverizing the clay or loam and mixing it with the cement than by mixing it with the sand. It is probably not worth the extra time and expense to follow the latter program if increase in strength is the only object in view in adding the clay.

Mr. Gaines's theory of the action of the clay in producing impervious mortar is based on a chemical principle and to produce the full action the close association of particles obtained by mixing the dry clay and cement is necessary if his theory is correct. His experiments show an accompanying increase in strength of mortar, showing that so far as this effect is concerned the method of adding the clay is not important.

In connection with his development of the theory of the "poured house," Thomas A. Edison made some experiments which are reported to show that the addition of a certain not stated proportion of colloidal clay will make mortar fluid without adding so much water as to permit prompt separation of the heavier aggregates in the concrete.

There are no definite figures concerning effect of clay on time of setting. The experimenters who mention the point state that the time of final set is delayed but do not refer to the time of initial set.

It will be noted that the proportions of cement, clay and sand are differently stated in the experiments, Mr. Gaines substituting clay for an equal amount of cement in the mixture and all tne other experimenters adding a proportion of clay to the sand. If he puts 10 per cent. of clay into his cement and other experimenters put 10 per cent. of clay into their sand, 1 to 3 mixture in each case, his mixture becomes 0.9 cement: 0.1 clay: 3 sand and theirs becomes 1 cement: 0.3 clay: 2.7 sand, or 1.1 cement: 0.33 clay: 3 sand, and his ratio of cement

to sand is some 20 per cent. higher than theirs. This fact must be taken into account in making any detailed comparison of results.

There is not complete agreement by experimenters as to the possibility of producing water-tight concrete by mechanical means. Some who have experimented with fine sands and stone dust think that water-tight concrete cannot be obtained by their use, while others who have studied the methods of filling voids by mixtures of aggregates of pre-determined proportions of sizes are disposed to think it can be obtained on construction work as well as in the laboratory. Possibly some of the waterproofing materials on the market serve the same purpose as the colloidal clay. Certainly others answer more or less well to the description of an electrolyte. There is a good field for experiment here under both the mechanical and the chemical theories presented. Whether strength is affected by the same qualities that influence permeability, or depends upon other qualities is also open to study. Strength evidently increases as permeability decreases but quite possibly not for the same reason.

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## THE LOS ANGELES AQUEDUCT.

*By L. C. Breed, St. Louis, Mo.*

THE pueblo of Los Angeles, upon its establishment in 1781, was invested by the laws of Spain with the right to take and use the waters of the stream flowing across its Angeles river, for all public and doboundaries, now known as the Los mestic purposes. This right descended to its successor, the city of Los Angeles, and is the most valuable asset of the municipality.

In the fall of 1904, the Board of Water Commissioners notified the public that the time had come when it would be necessary to supplement the flow from the Los Angeles river. After thorough investigation, a movement was inaugurated to secure Owens Valley waters.

The total quantity of water at present available for the city's use is about 46,000,000 gallons daily. The water consumption of Los Angeles is 190 gallons per capita. The new source of supply would admit of furnishing 250,000,000 gallons per day.

The idea of bringing the water of the Owens river to the city of Los Angeles originated in 1893 with Mr. Fred Eaton, who was for several years engineer and superintendent of the City Water Company. In 1905 the special committee of the Chamber of Commerce reported favoring Owens River Valley as the source for a new water supply. They stated that there is an ample supply and that the quality of the water is satisfactory. They also found that the total outlay will probably come well within the estimate of $21,500,000, made by Mr. William Mulholland, engineer of the water department.

Shortly after this report was made, the bonds were voted, the majority given the issue being greater than in case of any previous issue in the city of Los Angeles.

Owens Valley is situated in Inyo county, California, and lies entirely within the boundary line of this State. The northmost point of this drainage basin adjoins the Yosemite National Park. Its western boundary is the crest of the Sierra Nevadas, the loftiest range in the United States. Owens river is a stream about one hundred and fifty miles in length.

The main canal has been opened for a distance of five miles and partly graded. About six miles of wagon road have been built along the proposed line of the aqueduct on the west shore of Owens Lake.

The estimates clearly indicate that there will be marked economy in building a railroad for the purpose of hauling freight for the aqueduct. The city, however, wishes to avoid the construction of this railroad and negotiations have been taken up with the Santa Fe and with the Southern Pacific railroads.

There are five engineering parties busy in the field. These parties consist of fourteen men and ten animals each. They encamp in the locations selected for their work.

The big Elizabeth Lake tunnel is well under way; this is the longest on the line and will be about 25,000 feet in length exclusive of the deep ap-

proaches at its two ends. It must be driven from only four headings, two of which will start from a shaft about 350 feet in depth located in the valley near Elizabeth Lake. With the exception of the Gunnison tunnel in Colorado it is said to be the longest of this kind in the world.

Midway of the conduit line, the city of Los Angeles is to establish a cement plant, as it has been demonstrated that in the vicinity the materials for the manufacture of superior Portland cement are available. The estimated cost of the mill (1,000 bbls daily capacity) is $300,000, and as about 1,300,000 barrels of cement will be required, it is regarded as desirable to manufacture it. As the city will not exhaust the deposit of clay and limestone, it is believed that the plant at the end of the construction of the aqueduct will be worth almost as much as it cost the city.

In general, the plan of the aqueduct is to be of concrete, partially open, 12 by 14 feet, with sloping sides. Steel inverted siphons and tunnelling will be necessary features of the aqueduct, which will extend from the heart of the Sierras southward a distance of 240 miles to Los Angeles. The tunnels will have a capacity of 20,000 miner's inches of water. Ultimately it is expected the engineers will be able to construct fifty miles of aqueduct each year.

The scheme of diversion and storage contemplates providing three reservoir sites. At the Fernando site, however, there will be two reservoirs, the head of the San Fernando Valley being the end of the conduit. These reservoirs are at a mean elevation of 1,200 feet and have a splendid location as distributers. In case of a serious break in the main conduit, the two reservoirs, if full to start with, would furnish a 500 second-foot draft for 36 days; a 400 second-foot draft for 46 days, or a 300 second-foot draft for 61 days.

The city is engaged in building an electric plant at Division crek and another one on Allenwood creek, the latter of 200,000 h. p. with transmission line extending for a distance of 90 miles, for excavating on the descent of the tunnel.

OWENS RIVER BELOW INTAKE OF NEW LOS ANGELES WATER SUPPLY.

In San Francisquito canyon for upwards of forty miles there is a drop of 1,500 feet.

It is the intention of the city to provide electric energy and also to supply water for irrigation purposes, as there are upwards of 75,000 acres near Los Angeles practically barren on account of lack of water.

The undertaking at first blush seem almost unwarranted, or in other words, the outlay might be greater than the resources of a city of the size of Los Angeles fully justified. A careful consideration of the possibilities of the enterprise presented by the city government makes a good showing and tends to silence adverse criticism. The water furnished by the city is sold to

its citizens for domestic, factory and other local uses. In addition to these uses the city proposes to sell water to parties along the route for irrigation and also for power plants. The development of unproductive land will result in bringing in settlers, and the creation of electrical energy, providing power for manufacturing, also will draw both capital and workmen to the territory thus supplied. All this new population will naturally do their buying in Los Angeles, and in turn the city will serve as a market for a goodly share of the productions of the farm and the factory.

Los Angeles has grown so rapidly in population and expanded so wonderfully in commercial and industrial lines that the city has not been able to keep pace in providing public improvements and although great tasks have been accomplished, still more stupendous undertakings are now engaging public attention. Besides the aqueduct, the improvement of the electric railway system and the development of the city's port at San Pedro constitute the chief of the enterprises now under way.

---

## A REINFORCED CONCRETE STANDPIPE.

*By Walter B. Snow, Boston, Mass.*

WHAT is doubtless the largest reinforced concrete standpipe yet constructed is in the town of Attleborough, Mass. Its erection was necessitated by the inadequate fire protection and the lack of water for domestic purposes provided by the then existing pumping station. Although Attleborough water is of the best, it contains so much carbon dioxide that the serviceability of iron tanks is of comparatively short duration. On this account bidders were allowed to present plans and specifications according to their own ideas of construction, each one specifying the amount of steel to be used, amount of concrete and factor of safety, with complete plans and method of construction, confining himself to the general design of foundation, standpipe and gatehouse; the structure was to be guaranteed by the builders for one year from date of acceptance by the commissioners.

"After a careful study of all plans submitted and methods of construction proposed, we considered," says Superintendent George H. Snell in his report, that the Aberthaw Construction Company's bid ($34,000) was the one to accept, if any, for the following reasons: Extra steel reinforcement, richness of concrete, method of construction, and complete plans submitted.

"We had an estimate on a steel standpipe of the same size for $37,135, making a difference of cost between that bid and the one accepted $3,135.

"The advantages of a concrete steel standpipe over a steel standpipe are:

"First. The cost would be $3,135 less.

"Second. No cost of maintenance.

"Third. There seems to be no limit to the life of such a structure; or, in other words, is as nearly indestructible as a structure could be made.

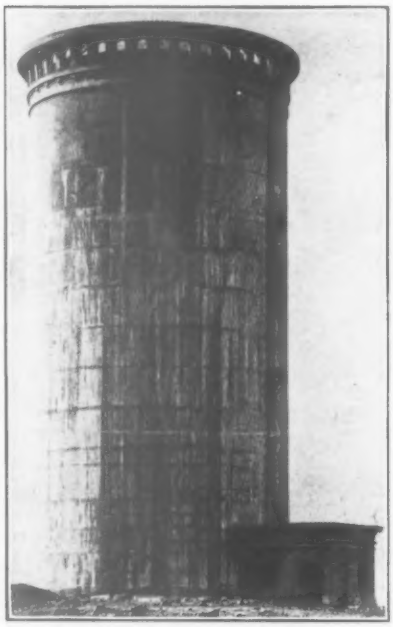
"The maintenance of a steel standpipe of that size with our quality of water would be $400 per annum if kept coated on the inside and painted on the outside, and the probable life only twenty years. It would also be necessary to empty the tank annually to clean out the rust and do the painting, which would probably take at least two weeks. During that time water would have to be supplied by direct pumping, which means continuous expense of not less than one hundred dollars per annum. You can see, by this comparison that there was much in favor of the concrete steel standpipe over the steel standpipe. It seemed to us, in our judgment, it was far better to accept the concrete proposition."

The standpipe in question is 118 feet high by 50 feet inside diameter, with an adjoining gate house 18 feet by 18 feet by 16 feet high. The walls are 18 inches thick at the ground level and 8 inches thick at the top. At a depth of 7 feet was found a good hard bottom on which to rest the concrete foundation. A reinforced filet of generous proportions connects the walls and bottom pan. Extending entirely around the base of the tower is a reinforced concrete curbing 1¼ ft. thick by 3 feet high, rounded at the top.

The concrete used was of the pro-

portion 1 part cement, 2 parts sand and 4 parts crushed stone.

Horizontal reinforcement consists of round bars varying in diameter from ¼ inch to 1½ inches. It was originally intended to use ⅝-inch twisted bars for vertical reinforcement, but as the difficulty of keeping the horizontal members in place was met with, channels were substituted, there being 15 in number, equally spaced. These were drilled at intervals for the reception of short ½-inch bars upon which to rest the horizontal bars. This method of holding the latter members in place was all that could be desired. The horizontal bars were delivered in lengths of 56½ feet, necessitating the use of three to span the circumference with an overlap of each of 30 inches with which to clamp them together. The bottom pan and filet is reinforced by ¾-inch bars spaced 6 inches, running at right angles to each other.



CONCRETE STANDPIPE AT ATTLEBORO, MASS.

In the final design the horizontal steel reinforcement consisted of 1½-inch plain round bars in double vertical rows extending from the ground to a heighth of 60 feet. Above this a single row was used which at 81 feet was reduced to 1⅛ inches diameter. The steel is protected throughout by from 2½ to 3 inches of concrete. The spacing of the double horizontal steel members varies from 3¾ inches center to center to 8 inches; that of the single 2½-inch row 4⅛ inches to 6 inches, and that of the 1⅛ inches row 3½ to 6⅝ inches on centers.

In order to make the standpipe thoroughly tight, alternate coats of a solution of castile coap and alum were applied to the interior, the first 35 feet with eight and the remainder with four coats.

Circulation of water is insured by discharging into the standpipe through a pipe 40 feet from the base and withdrawing through a 24-inch pipe at the bottom of the tank.

The top of the tower is covered by a Guastavino tile roof and ornamented by concrete pendants.

## SOME SALT LAKE CITY IMPROVEMENTS.

SALT LAKE CITY, Utah, is a city which has decreased in area from year to year, for in 1867 its area was fixed by statute at 57.157 square miles, and it has been reduced in area some 12 miles by three proceedings, while only 1.417 miles has been added by ordinance, so that the area now is about 46.5 square miles. This shows the liberality of the scale on which the city was originally planned.

The real improvement of the city began in 1900, when the improvements amounted to nearly $150,000 for the first time in a number of years. They were $125,000 in 1903 and nearly doubled each year for the next four years. The city engineer's report shows the cost of engineering each year since 1901 and that it varied from 2.94 per cent. of the cost of the improvements in 1902 to 8.85 per cent. in 1905. It is evident that the city engineer's office was greatly enlarged in 1905, in anticipation of greater expenditures, and the expenditure in 1906 was slightly less and the percentage cost of engineering dropped to 3.45 on account of the doubling in amount of work done. With the exception of 1905, the cost of engineering is each year less than 5 per cent.

The character of street improve-

I. INTERCEPTING SEWER, SALT LAKE CITY, UTAH.

ments was shown by an article in MUNICIPAL ENGINEERING, vol. xxxiv, p. 134. The illustrations accompanying this article show some of the general improvements in the city. The first photograph shows a section of an intercepting sewer which runs through the western part of the city, being 15 and 18-inch vitrified pipe at the southern or upper end, and 30 to 40-inch concrete for the remainder.

The Commercial Club of the city and many citizens are greatly interested in the construction of Wahsatch boulevard, which would give a driveway from which many attractive views of the city and the neighboring mountains, lake and valley can be obtained. By the expenditure of about $800 on the concrete culvert shown in the second cut, the city secured the expenditure of $4,500 in grading the boulevard at this point, thus advancing the improvement one step.

MUNICIPAL ENGINEERING has had inquiries for information about the construction of band stands with shells, and is indebted to Mr. L. C. Kelsey, the city engineer of Salt Lake City, for the opportunity to present the plans shown in the third plate, as well as the other illustrations accompanying this article. This stand is designed in wood, and with low lumber prices would cost about $2,000, but when bids were received lumber was high in price and the lowest bid was $2,950, so, the bid being above the limit of the appropriation, the stand was not built.

The fourth cut shows the public comfort station in Liberty Park. The park having no sewer connection, the station is set over vaults excavated in the ground and lined, but the same design could be used with water closets. Inquiry may be made as to the sufficiency of light and air in the closets as shown.

The fifth cut shows the handsome city and county building, which also contains state offices. This is the most prominent civic exhibit of Salt Lake City, and is an example of what can be done by co-operation of civic bodies, no one of which could approach this building in size, appearance or convenience. The sixth cut shows one of the more modern fire department houses.

## NIGHT SOIL COLLECTION AND DISPOSAL.

THE information bureau of the American Society of Municipal Improvements has collected from 42 cities information about the collection and disposal of night soil which shows the unsatisfactory nature of the system of disposal of this class of refuse where large quantities are to be removed. Fortunately most of the larger cities are so well sewered and connections with the sewer are so general that but little such service is required. The information is largely instruction as to how not to do it in large quantities.

The principle of the ordinary privy vault is bad and a city board of health in a small city not likely to put in a sewer system should seriously consider the earth closet or some system which will reduce the nuisance in the neighborhood as well as in the process of removal.

There are six Massachusetts cities in the list. In Somerville all buildings are sewered and in Holyoke only 30 houses are not sewered, while in Worcester one team does all the work in spring and fall, so that the problem is one of little moment. Lowell does not state the amount disposed of, Springfield has 3,000 tubs of 3½ cubic feet capacity a year and New Bedford has 9,000 to 10,000 barrels a year.

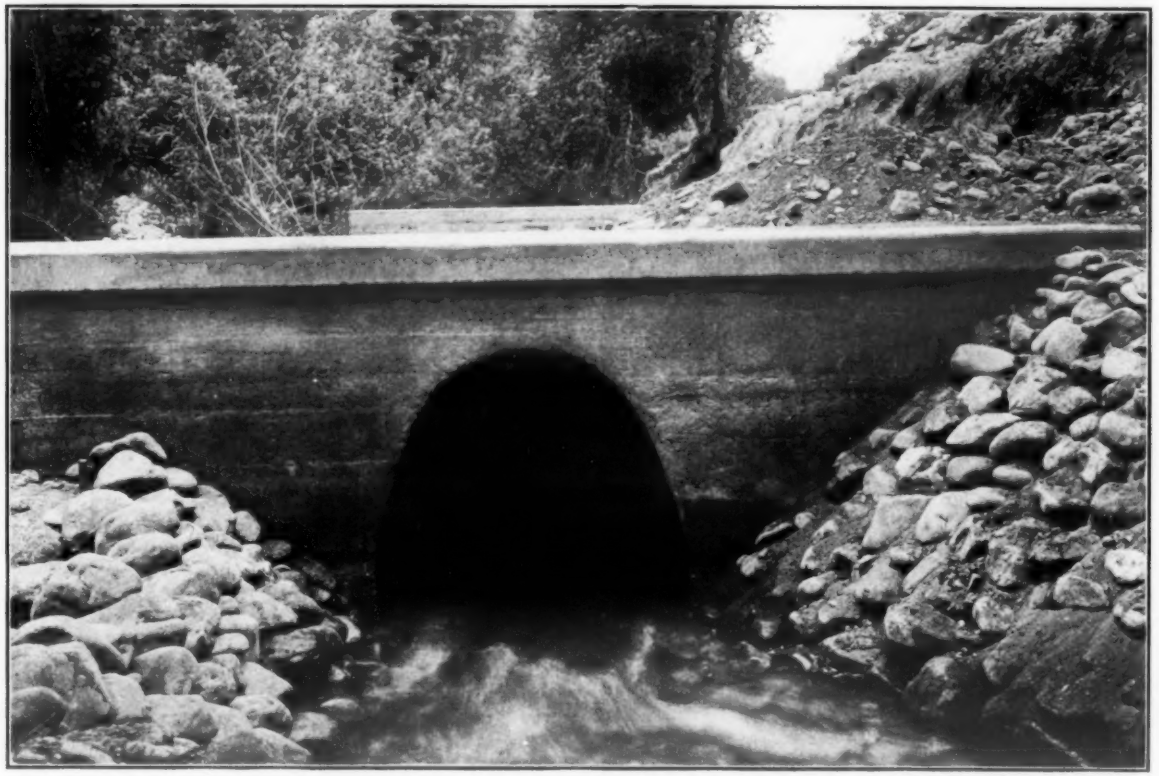
Pawtucket, R. I., apparently has little trouble, but does not state the amount disposed of. Providence has 17 licensed carts with work for less than half that number, 90 per cent. of the city being sewered.

Hartford, Conn., has very little.

The New York cities have very little, Albany having practically none, as almost all houses use the sewers, Buffalo not enough to keep one man busy, Syracuse about 3,000 loads a year and Rochester and Troy not knowing the amount, both having comparatively few privy vaults and these rapidly disappearing, in Troy by order of the board of health whenever a district is sewered.

Hoboken, N. J., has no night soil, the city being all sewered. Elizabeth has very little for the same reasons, and Camden about 600 tons a year to 150 cu. feet a day, according to various estimates, and 8,000 suburban residents are said to use it on gardens.

Harrisburg, Pa., has very few houses not sewered and Pittsburg has only 1,600 loads a year. Reading does not



II. CITY CREEK CULVERT ON WAHSATCH BOULEVARD, SALT LAKE CITY, UTAH.

know how much is removed as it exercises no control, and as its officials are satisfied with the condition there is evidently little material to produce trouble.

Baltimore, Md., is the only large city except New Orleans without a complete system of sewers, and 402,234 barrels of night soil were taken to barges and probably 90,000 more barrels were actually collected. A new sewer system is now under construction and the present conditions, which are reported to be "as satisfactory as possible," have already begun to improve.

Washington, D. C., collected in the last year 21,094 barrels, although the city is quite well sewered.

Charleston, S. C., still has many vaults, 2,434 having been cleaned in 1907. The condition is reported to be obnoxious and unsanitary, although subject to the regulations of the board of health, and that city might well consider the earth closet for the parts of the city which cannot well be sewered in the present condition of the municipality.

Augusta, Ga., has none to remove, and Savannah has 9,612 barrels a year, which cost $3,100 to dispose of for use as fertilizer.

Ohio cities are apparently not so well sewered, Youngstown cleaning about 1,000 vaults a year, and Cincinnati 2,415 vaults in 1907, while Columbus removed approximately 210,000 cubic feet and Cleveland 10,000 cubic yards in 1907. Dayton has no record of the amount removed, and reports that the present method is satisfactory "so far as is known," indicating tnat the inspection and regulation by city officials called for by the ordinance are not performed and the conditions are such tnat no complaint is made of them.

Fort Wayne, Ind., does not know now much night soil is removed, and is reported to prosecute contractors for removal if their work causes nuisances. South Bend removes 12,000 barrels a year.

Saginaw, Mich., exercises no control over the matter except the board of health occasionally orders a vault cleaned, and does not know how much is removed.

Milwaukee, Wis., removes 8,000 to 10,000 cubic yards a year, and the amount is diminishing as vaults are condemned.

Des Moines, Ia., removed 1,154 loads in a year.

Louisville, Ky., exercises no control over removal and guesses that the amount is approximately 1,000 tons a year.

In New Orleans, La., the amount is very large, as every house has a vault or a cesspool, but no one knows how much. A sewer system is now under construction, the city having been without heretofore, and the use of the vaults will be discontinued as rapidly as possible.

Dallas, Tex., removes 500 cubic feet a day.

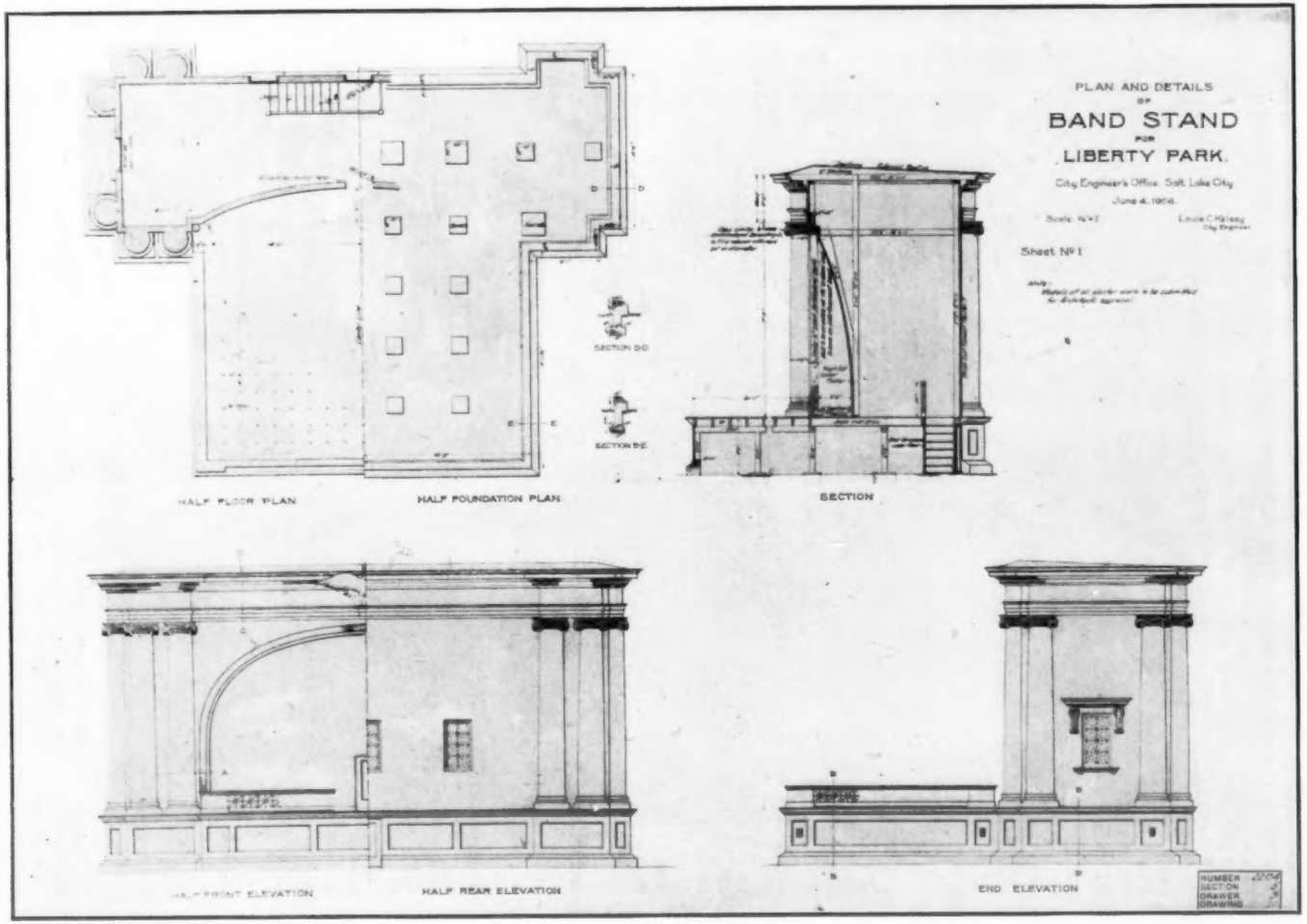
Seattle and Tacoma, Wash., have none to remove, the cities being completely sewered.

Los Angeles, Cal., is in the same condition.

Contractors remove the night soil under permits in Lowell and in Worcester, where there is but one contractor working a part of each year. Licensed contractors are used in twelve cities, and private contractors, not reported as licensed, in sixteen cities. In one the board of health lets the contract at figures paid by the property owner. Washington, D. C., and Savannah, Ga., let contracts for removal, the expense of which is paid by the city. Cleveland, O., and Grand Rapids, Mich., do the work through a city department.

The city exercises more or less complete control in twenty cities, eleven through the board of health. Limited control is exercised in eleven cities and no control in one. The reason for unsatisfactory conditions is not in the power of regulation possessed by the city, but rather in the attempt to regulate the operation of a system which is wrong in principle, instead of devising and instituting a system which can be regulated. The difficulty is not alone with the removal of the night soil, but also with the vaults from wnich it is taken.

The reports regarding the satisfaction which the present methods give are not very reliable, partly because they are made by men too often indifferent and largely ignorant on the subject, particularly when the report is made by one department head and the matter is in the hands of another. However, twelve answer simply yes, and this number includes cities where the work is heavy, as well as some where it is light. Another, Worcester, says it has been satisfactory for twenty-five years, during which the city has had the same contractor. Another apparently thinks the present method is satisfactory because there are no complaints, another because the suburbs only are so served, and another because there are but few




III. PLANS FOR A BAND STAND.

vaults and they are rapidly disappearing.

Saginaw and Des Moines say the system is generally satisfactory, Baltimore that the system is as satisfactory as possible, Charleston that it is best done under the circumstances, but obnoxious and unsanitary, Dayton that it is satisfactory so far as is known, New Orleans as satisfactory as conditions permit. Springfield, Providence, Troy, Cleveland, Columbus, say their systems are fairly or reasonably satisfactory. Pittsburg, Youngstown, Louisville, say their systems are not satisfactory. Grand Rapids has been estopped from dumping in some outside townships on account of nuisance, but Des Moines thinks the method the two cities use, that of dumping in pits outside the city and covering, is the only way for satisfactory disposal.

The apparatus used in collecting the night soil consists of air-tight barrels and tanks in twelve cases, of tight or covered barrels or tanks in twenty-one, and Albany has no regulation. Most of those using air-tight barrels and tanks use pumps for forcing the material into them. Three mention the use of dippers for filling tanks and barrels and others doubtless use an equivalent. Three mention the use of disinfectants, viz., Elizabeth, Louisville and Troy, and most cities require the operation of removal to be odorless. Youngstown reports dipping into wooden tanks under contract let by the board of health, payment made by property owners, to be unsatisfactory. Louisville reports removal by air-tight barrels on wagons, with disinfection and deodorization, the health office having no control except to condemn vaults, is by no means satisfactory. The other reports indicate that the manner in which the work is done by the contractor is the basis of the report regarding the satisfaction with the system, rather than the nature of the system.

The night soil is used for fertilizer, direct or after preparation, in fifteen cases, is dumped on land and buried without reference to its use as fertilizer in nine cases, is dumped into a sewer in four cases and into bay or river in three cases.

The cost of removal does not vary as much in the reports as might be expected, when they are all reduced to a common basis. The expense is paid by the property owner in all cities but Washington, where the removal of 21,094 barrels last year cost $16,500, the lump sum contract price per year, and Savannah, Ga., where the removal of 9,612 barrels cost $3,-100. The prices paid may be grouped as follows:

Columbus and Dallas, 10 cents a cubic foot, and Youngstown, 12 to 14 cents a cubic foot, the latter under a contract let by the board of health. Lowell, 20 cents a barrel; Charleston, 33 1-3 cents; Dayton, O., 35 cents; South Bend and Grand Rapids, 50 cents; New Bedford, $2 for 12 barrels; Syracuse, $5 for 5 barrels; Springfield, $1.50 for 1 to 3 tubs, up to $10 for 46 to 48 tubs; Lowell, $3 for tank of 60 cubic feet; Worcester, $4 for 60 cubic feet.

Cleveland, O., department of public service does the work and charges $1.90 per cubic yard if inside city limits and $2.50 if outside, slightly more than cost; Milwaukee, $3 a cubic yard. Pittsburg, average cost, $10 a load.

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## WATER RATES CHARGED IN AMERICAN CITIES.*

*By Dow R. Gwinn, Terre Haute, Ind.*

IN December, 1906, a request for information in regard to water rates was mailed to the officers in charge of the water works plants in 160 cities of the United States having a population of at least 25,000, as shown by the United States census of 1900.

Information was received from all but three cities. One official requested that the information be not published; hence it is not included in the list. In January, 1907, similar requests for information were sent to a large number of cities having less than 25,000 population, according to the United States census of 1900. In compiling water rates it is very important that the officer in charge of the plant should write the information on the card furnished for that purpose, for the average printed rate sheet is not always clear to one not familiar with it. Most of the officers replying to the request for in-

*From a paper before the American Waterworks Association.

IV. PUBLIC COMFORT STATION, LIBERTY PARK, SALT LAKE CITY, UTAH.

formation filled in the rates on the card; some did not do so, but sent copies of the rate sheets. The most popular method of paying rates for domestic or family use is the "room" plan. Next in popularity is the "person's" plan, and next the "first faucet" plan.

Some cities have a rate for domestic use which includes bath, closet and basin without additional charge. It was the aim of the compiler to adapt, as closely as possible, the various rates under one general form in order to have a basis of comparison. Any one who has made a similar attempt will appreciate how difficult it is to do this. Where there was a question as to the rate for a certain privilege, the lower rate was invariably taken.

The figures recorded in the tables were checked and re-checked, and efforts were made to reduce the errors to the minimum. Errors will no doubt be found, but they will probably not materially affect the general average. The compiler believes that the average rates as given are practically correct, and represent the rates charged in the principal cities in the United States. An extra effort was made to secure rates from cities having filtration plants.

Some cities do not furnish water except through meters.

Some flat rates furnished were either ambiguous, or were on such a basis as to make it impossible to arrange them under the headings adopted. Under these conditions the meter rates only were used. A few cities filter a portion of the supply; these were included with those cities where the entire supply is filtered.

It would be impossible to fix a rate for water which would be fair both to the consumer and water purveyor in all cities, owing to the great difference in local conditions. Gravity supplies that are pure enough without filtration, in reasonably close proximity to the municipality, represent the ideal condition.

On the other side, there are cities where the supply is taken from muddy rivers and the water is in such a condition as to make it necessary to have large sedimentation basins in connection with filters. In most cases where river water is filtered, it is necessary to pump water twice, and the writer knows of one case where part of the supply is pumped three times. Take a combination of this kind, with the cost of coagulants and extra fuel for double or triple pumping, and add the cost of furnishing fire pressure, and there is a vast difference in cost of furnishing water as compared with a gravity unfiltered supply.

And there are artesian well plants where it is necessary to pump the water twice. Those who are compelled to pump water from a depth of 150 to 200 feet below the surface of the ground and then pump into the pipe system against a pressure of 45 to 110 pounds, can testify that the cost of fuel per thousand gallons pumped is sometimes equal to the amount charged by some municipalities.

A great many people have an idea that water should be as free as air, and the writer believes this thought is responsible, to a certain extent, for the very low rates charged for water. There is no public service which the writer knows of which is so poorly paid for as the water supply. While every one will admit that a telephone is a great convenience, just compare that service with water service in a kitchen and bathroom privileges. Which is the greatest necessity and convenience? As a rule, telephone service costs considerably more than water service.

The usual switching charges for a car inside the limits of a moderate sized city is $1.50; on the basis of 30-ton cars, this is 5 cents per ton. Water at 20 cents per 1,000 gallons is less than 5 cents per ton. The cost of water delivery at 20 cents per 1,000 gallons is less than the cost of switching a car on the basis of 5 cents per ton.

This does not take into account the cost of the commodity. In many parts of the United States the cost of water at the station ready for delivery into the mains is no inconsiderable amount. It is claimed by some city officials that their water departments are making money at the low rates charged, and they point with pride to the annual reports. In most of these reports one can look in vain for a charge of interest on the investment not included in the bonded debt; also for a charge for taxes, which would be paid if the property was owned by individuals.

There are broad-minded officials who recognize the fact that money invested in a business should earn a reasonable rate of interest, whether it is a private business or a public one; that involuntary investors in a public business are entitled to as much return on their money as the stockholders in a private company.

All persons who give the matter a little thought can see that if a certain piece of property (public or private)

V. CITY AND COUNTY BUILDING, SALT LAKE CITY, UTAH.

does not pay taxes, its proportion must be made up by those who do pay taxes.

Although some city officials do not consider that it is necessary to include interest on investment and taxes when arriving at the cost, the United States government has set its approval upon this method. (See Fourteenth Annual Report of the Commissioner of Labor, 1899, Water, Gas and Electric Light Plants, page 18.) The Department of Labor also includes in the production cost, depreciation on cost of works, exclusive of land, rental value of quarters occupied free, legal expenses and renewals. All of these, including interest on investment and estimated taxes, are a part of the cost of production, and unless they are given in the annual report of the water department, it is impossible to tell what the cost is. Some annual reports of water departments do not show interest on bonded debt, as that is paid out of the general fund. Others do not show appropriations made from the general fund. Some of our older members may remember a discussion at one of the earlier conventions, when it was contended that a certain city did not pay one cent to the water department for rent of fire hydrants. Further probing showed that an annual appropriation of $75,000 was made for the water department.

The object of the writer in giving these statements is to suggest that it is impossible to tell by the average water department's report the cost of furnishing water, or whether there is a loss or profit in conducting the business. Unfortunately, the rates charged by some municipalities are sometimes used as a basis for reducing the rates charged by private companies. There are a few departments that show the cost of pumping and delivering water, and in one of these cities the cost is shown to be about 7 cents per one thousand gallons. This does not include filtration.

In the writer's opinion, if the actual cost of water furnished by municipalities was known, there would be a general advance in the rates charged. The writer believes that a consumer who uses water in small quantities in a city where the water is filtered or must be pumped twice, should pay at least 40c per thousand gallons. And there are cities where the rate should be higher. The service rendered to a householder supplied with filtered or artesian water through a meter should be worth at least $1.00 per month. This is only 3 1-3c per day. If the privilege of using artesian or filtered water in the kitchen, in the bath room, and for any purpose, at any time, day or night, is not worth 3 1-3c per day, it is not worth anything. The "readiness to serve" charge in connection with meters should be at least $1.00 per month or $12 per annum, net. (The writer would not advocate the setting of meters on service pipes to supply small houses with a single faucet.)

The average charge in 134 cities supplied by private companies, for a 6 room house, bath, closet, basin and 50 feet sprinkling is approximately $21.00. This is not high enough where water is furnished under difficult conditions. The writer would prefer to divide the various items a little differently than the averages indicate. The water closet rate, say 70 per cent. of the domestic rate, the stationary wash basin rate, 15 per cent. and the sprinkling rate should be, at least, equal to the domestic rate. The average rate for domestic use in a 6 room house in 149 cities supplied by companies was found to be $6.83. Now, the writer believes that where the water is filtered, or where there is double pumping, the rate should be 25 per cent. higher than where water is furnished under ordinary conditions. Assuming that $6.00 is a fair rate for domestic use in a 6 room house where water is not filtered and is only pumped once, and that filtered water, or water that is pumped twice, is worth 25 per cent. more than the unfiltered the result would be as follows:

| | Ordinary Conditions. | Double Pumping or Filtration. |
|---|---|---|
| Domestic use, 6 rooms.... | $6.00 | $7.50 |
| Barn, with or without hot water ..... | 3.00 | 3.75 |
| Water closet (self-closing) | 4.20 | 5.25 |
| Wash basin ..... | .90 | 1.13 |
| | $14.10 | $17.63 |
| Sprinkling 50-ft. lot in connection with above uses. | 6.00 | 7.50 |
| | $20.10 | $25.13 |
| —Meter Rates.— | | |
| Minimum monthly rate....$ | .80 | $1.00 |
| Sliding scale— | | |
| Highest meter rate, per 1,000 gals., net..... | .32 | .40 |
| Lowest meter rate, per 1,000 gals., net..... | .08 | .10 |
| Special rate where consumption is 3,000,000 gals. or more per month. | .065 | .081 |

Owing to the many leaks that occur in water closets, it is only fair that such fixtures should pay a higher rate than bath tubs. The regulation of sprinkling is one of the most difficult problems that confronts water works' officials. If all the service pipes having sprinkling fixtures were supplied

VI. FIRE STATION NO. 5, SALT LAKE CITY, UTAH.

through meters, the trouble caused by violation of sprinkling rules would be practically eliminated.

In some localities, particularly where it is extremely difficult to get water or where freight rates on pipe and machinery are so excessive as to materially increase the investment in the plant, a basing rate of $6.00 is not high enough. Cities where it is necessary to pump direct and to furnish fire pressure whenever called for, should have a higher basing rate than cities where fire pressure is not required.

The standard of public water supplies is being raised. Water of better quality means higher cost. Higher cost of production means higher rates. The public demand good, wholesome water and should have it, but the price should be commensurate with the service rendered. Water rates in many cities have been, and still are too low. Some city officials are realizing that they are furnishing water at much less than cost. In few places the rates have been raised. Where water is delivered to any part of the city, at any time when called for, at about the cost, on a tonnage basis, of switching a car, it is time to raise the rates to a point where the department or company will get something for the water as well as for delivering it.

The paper contained tables giving the rates in each city from which reports were received. The following is the summary of averages of the results in the tables:

AVERAGE ANNUAL AND METER RATES CHARGED IN 375 CITIES.

| | Private owned Plants. | Public owned. Plants. | Both Private and Public. |
|---|---|---|---|
| Domestic use in 6 room house or 5 persons or 1st faucet | $6.83 | $6.04 | $6.40 |
| Additional for 1 bath, hot water connections | 3.88 | 2.99 | 3.40 |
| Additional for 1 self-closing water closet | 3.69 | 3.12 | 3.38 |
| | $14.40 | $12.15 | $13.18 |
| Additional for 1 basin, hot water connection | 1.94 | 1.55 | 1.74 |
| | $16.34 | $13.70 | $14.92 |
| Additional for sprinkling 50x140-ft. lot, including side walk and street in front | 6.17 | 4.37 | 5.20 |
| Total charge per annum for all the above privileges | 20.83 | 16.34 | 18.33 |
| Schedule Meter Rates— | | | |
| Highest per 1,000 gallons | .318 | .218 | .262 |
| Lowest per 1,000 gallons | .108 | .079 | .092 |

| | |
|---|---|
| Number of reports from cities with private owned plants | 162 |
| Number of reports from cities with public owned plants | 213 |
| Total number of reports received | 375 |

(Several plants have been purchased by the municipality since the information was received.)

| | |
|---|---|
| Average population of cities (1900) with private owned plants | 25,437 |
| Average population of cities (1900) with public owned plants | 85,382 |
| Average population of cities (1900) all cities reporting | 59,577 |

## CREOSOTED WOOD BLOCK PAVING.

*By H. C. Innes, Consulting Engineer, Cincinnati, Ohio.*

WOOD makes a comparatively noiseless, sanitary and smooth pavement, which is easy to clean, and it gives satisfactory results as to durability. Like all smooth surfaces, when covered with sleet or slime it is perhaps slippery. It is not suitable for heavy street grades. A wooden pavement consists of rectangular wooden blocks, usually long leaf yellow pine, impregnated with dead oil of coal tar or creosote. The real value of the pavement consists of carefully selecting good timber and suitable oil and properly treating the block through the several stages required to fill the cellular openings in the timber. Specifications for this class of paving material often call for heart pine. It is very difficult to im-

VII. LOUIS C. KELSEY, CITY ENGINEER, SALT LAKE CITY, UTAH.

pregnate heart pine. To do so you must heat the wood possibly to the point of destroying the fibers, and this should be very carefully avoided.

A creosoting plant consists of large cylinders, possibly from 6 to 9 feet in diameter and from 80 to 136 feet in length, capable of standing a pressure of 150 to 200 pounds, with doors which can be hermetically sealed. These cylinders are fitted with a track, heavy pipes or coils capable of maintaining 250 degrees F., with other fittings and connections. Other needed machinery and equipments are large steam boilers, gauges, condensers, vacuum pumps, pressure pumps, cars fitted with cages, oil pumps, storage oil tanks, pulverizers, sawmill, derricks, superheaters, pyrometers, etc., arranged conveniently to perform certain requirements during the progress of treating the wood.

Usually the lumber is received cut to width of 3 or 4 inches. It is easily examined and inspected, and is then cut into such length as may be required, 3, 3½ or 4 inches. At times uniform widths of 8 inches are produced, again promiscuous lengths from 6 to 12 inches. A number of blocks are sawed at a time. These are thrown into a caged car and run into the cylinder. When filled the door of cylinder is closed and sealed. Dry heat is maintained for an hour or two, reaching about 285 degrees F., to completely sterilize the block, or super-

heated steam is used for the same purpose. By means of the vacuum pump sap and moisture are removed. The block becomes dry, and while the cylinder is under a vacuum of 25 to 26 inches of mercury, the creosote oil, at a temperature of about 175 degrees F., is run into the cylinder and a pressure of about 200 pounds per square inch is maintained until the blocks are thoroughly impregnated. Pressure and heat are reduced and cylinders are permitted gradually to cool for an hour. These cylinders are fitted with suitable gauges to properly determine quantity of creosote used per cubic foot of lumber. After treatment the cars are run out, the blocks cool, and are ready for laying.

A usual requirement is that after treatment the blocks will sink in water, or after subjecting them to a temperature of 100 degrees F. in an oven for 24 hours, weighing and then immersing in water for 24 hours and weighing, the increased weight shall not exceed 2 or 3 per cent.

The creosote oil or the mixture used to fill the cellular openings in the blocks is a very important factor in the preserving, the lasting of the paving material and the effectiveness of results. Some manufacturers use the straight commercial creosote oil, others a mixture of creosote and rosin, again creosote and asphaltum or creosote with petroleum residuum, and creosote with artificial rubber and rosin. Which proves the best, actual use of the blocks as a paving material will demonstrate. That which is affected the least by the summer's sun and the action of water will no doubt remain longest in the pores of the block and give the greatest lasting preservative qualities.

The creosote oil comes from the distillation of coal tar. Specifications covering the oil differ. Some oils will have a specific gravity of 1.03 at a temperature of 60 degrees F., liquefy at 90 degrees F., not boil under 400 degrees F., and contain 40 per cent. of naphthalene. Another will require the creosote to contain 6 per cent. of carbolic acid, be liquid at 122 degrees F., and be entirely soluble in benzine.

The specifications covering the oil as used by the city of Indianapolis require it to be a heavy creosote product, the specific gravity of which must not be less than 1.12 at 68 degrees F., and not more than 35 per cent. of it shall distill below 600 degrees F. with the thermometer suspended above the oil; the specific gravity of the residue obtained by distilling the oil up to 600 degrees F. shall not be less than 1.15; the oil must be free from free carbon, absolutely soluble in benzol so that it will readily penetrate the wood.

The theory of the treatment is that the material injected into the wood acts as a poison, killing all fungi which grow in wood and which otherwise would destroy it. It is essential to have all spaces completely filled. When so treated wood cannot decay. The wood fibers are strengthened and the block becomes firmer, denser, and waterproofed to a degree. The treatment is based upon so many pounds of creosote oil or mixture to the cubic foot of lumber. Creosote oil weighs about 8.7 pounds to the gallon. One cubic foot of lumber contains 12 feet B. M. and 1,000 feet B. M. contain 83.33 cubic feet. Oil varies in cost from, say, 5 to 9 cents per gallon. The labor item, fuel, interest and repairs to plant can be estimated at $3.00 to $5.00 per 1,000 feet B. M. of blocks treated. Green lumber is a very varying quantity, and difficult to estimate at all times. Paving blocks should be given all the creosote oil or mixture possible to take. This may be for some blocks 10 to 20 pounds per cubic foot of wood, depending upon the density of the wood, the kind of wood treated and the time taken in preparing and seasoning, previous to injection of the oil. Other kinds of wood have been treated and used for paving purposes with more or less success. Long leaf yellow pine seems to have given best results; yet, if properly and completely treated, other woods could give like service.

This class of paving, being light in weight, is admirably adapted for bridge floors, thus decreasing the dead load and reducing somewhat the dimension of bridge members. Some fifteen years ago the flooring on the Colerain avenue bridge, Cincinnati, was laid with a creosoted block, impregnated with wood creosote. It gave very good results.

For street paving the wearing surface is placed on a concrete foundation, using a cushion coat of sand or of dry mortar. The blocks are laid at right angles to the curb or at an angle of 45 or 22½ degrees. They are laid close together, at times with an expansion joint along the curb or gutter line, and at intervals of 75 to 100 feet across the roadway. The fiber of blocks is placed vertical. The surface is tamped or rolled and sand is sprinkled over it. At times a coating of hot asphaltum of high degree is worked over the surface into the joints

and then sanded. This adds to the complete waterproofing of the surface. The greatest desire and requirement is that the surface shall be completely waterproof and dampproof. Blocks which are not so soon expand and bulge by absorption of water to the extent of causing hollow spaces beneath, irregular surface and breaking up. The pavement, when carefully selected blocks are used, thoroughly treated and laid, should give highly satisfactory results for heavy, medium or residence street travel. Being a jointed pavement, it is easy to repair. Its first cost is somewhat high, but when considering the advantages, the cost of maintenance and life, the influence of high first cost is materially reduced.

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## THE CHICAGO UNDERGROUND RAILWAY SYSTEM OF REFUSE DISPOSAL.

*By Frank C. Perkins, Buffalo, N. Y.*

THERE has just been placed in operation in Chicago an electrically operated disposal station for receiving ashes, dirt from excavations and refuse of all kinds, the handling of the material being by electric power in the subways of the Illinois Tunnel Company. This station is located on tne river, and the tunnel cars as elevated will dump into scows, which in turn convey the refuse several miles out into the lake before dumping.

For years the excavation refuse of the city of Chicago has been dumped along the lake front, where the South Park Commission were filling in for additional parks, and a large percentage of the tunnel excavation was deposited there.

This year all dumping of refuse on the lake front is prohibited, and this necessitates disposing of the material by means of scows or loading it on railway cars and shipping it to the outskirts of the city. The advantages of this new method of the Illinois Tunnel Company through the electrically operated disposal station are readily seen.

Preparations have been made to receive, transport and entirely dispose of all excavated or surplus material from basements, sub-basements and caissons, as well as foundations, through these subway tunnels, also refuse and ashes from buildings and all waste material which engineers, contractors and building owners may wish to have removed. This disposal station was constructed by George W. Jackson, and a traffic contract has been made with the Illinois Tunnel Company to receive and transport by train all of the refuse material through its vast system of underground tunnels.

The central location of this disposal station, with its complete connections with the tunnel system by main trunk lines and by-passes greatly facilitates the movement of trains, and on this account they can be filled quickly, transported and the contents disposed of, after which they may be returned to the point of action to be refilled, without being hampered or delayed by weather conditions. It is only necessary to consider the slow method of moving material by teams, either in winter or in summer, to appreciate the opportunity afforded by this improved system.

The character of the scows used to transport material from the disposal station to the dumping ground makes it possible to operate every day of the year, regardless of weather conditions, ice or other difficulties. They are self-propelling and are built entirely of steel on the catamaran plan, with two heavily braced pontoons, supporting between them a rectangular receptacle of 1,000 cubic yards capacity. A number of sub-basements have been excavated to the tunnel level and the material disposed of by this method, the work progressing continually for twenty-four hours each day, resulting in no interruption to the business of the stores.

At the Majestic Theater and other buildings ashes and refuse are dumped into chutes located in the boiler room and cars are located in the tunnel under the chute to receive the material. They are hauled away by the electric locomotive.

The clearing of the streets of Chicago after heavy snowstorms can be accomplished by means of the tunnel system of waste disposal with great facility. An electrically operated

shovel has been designed and constructed for use in the speedy and economical handling of excavation material of all kinds by George W. Jackson, two electric motors being employed for operating this device, which handles coal, stone, gravel, slag or sand with great rapidity, and is of great service as a labor-saving device in connection with this disposal plant.

Coal connections are operated in a number of buildings, the trains being run in on a private siding, crossing weighing scales, which enables the coal to be weighed as delivered and then dumped into a pit, from which it is taken by a conveyor belt into the basement of the building and dumped into the hoppers of the self-feeding stokers. The coal is thus conveyed from the mines to the furnaces in the building without being handled or causing the confusion and annoyance incidental to the delivery of the fuel on the surface by wagon. A gravity yard has been built for the Chicago & Alton Railway, having a capacity of 5,000 tons daily, for the transfer of coal, broken stone or gravel from railroad cars to tunnel cars, and a similar gravity yard has been provided by the Chicago & Eastern Illinois Railway.

The various methods of connection of buildings with the tunnel for the service have been well designed for convenience and economy.

A well-equipped drainage system is required for these electric tunnels of over a quarter of a million feet. There are more than two-score recesses provided, in which are installed electric pumps, the discharge pipes of which are connected with the city sewers. These pumps have a total capacity of more than 10,000 gallons per minute, there being a dozen electric pumps of over 800 gallons capacity each, and nearly two-score of smaller electric pumps, each having a capacity of 100 gallons or less, these pumps being all worked automatically.

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## SYSTEM IN MUNICIPAL ACCOUNTING.

*By Marwick, Mitchell & Co., New York and Chicago.*

THE character of a man is known by the company he keeps and the management of a city can be judged in a very large measure by the books it keeps. While the books and accounting system do not directly come under the head of "Resources' o fa city, the fact that its business is carefully controlled and its accounts are annually examined and publicly disclosed in a reliable and intelligent manner is an asset, the possession of which will very quickly add to its prestige among municipalities. It is also a factor of very great value when it desires to borrow money.

It must be the earnest desire of all thoughtful people in a community that those elected to manage its affairs should have their willingness to do their duty supplemented by the possession of proper tools with which to do it. It is the unfortunate fact, however, that too often they are unable to exercise their administrative functions to the best possible advantage on account of the legacy which has been left to them by previous administrations in the shape of incompetent officials, inadequate records and misleading information contained in the previous annual reports of its finances issued by the city.

Dishonesty or breach of trust, while not a necessary adjunct to lack of method, is made much more easy by it and the representatives of the people should use all possible safeguards to protect the interests of the tax payers.

As public accountants, we have had wide experience in the intricacies of municipal finance, and while there have been notable exceptions, in the greater number of cases subjected to our investigation we have found no properly defined system of accounting in use.

From the majority of the accounts published also, the layman cannot get any idea whatsoever of the standing of the city, while even the trained mind can seldom extract the essential data from the figures published.

Amongst other defects is the very general omission of a statement setting forth the actual financial condition of the city. Again, many of the reports presented to tax payers consist merely of a recapitulation of cash receipts and disbursements. Such a statement is of no practical value to a city council, administrative officers or the public.

For economical management and effective administration, the revenues and expenditures applicable to each

year should be clearly shown apart from the actual cash receipts and disbursements of the year. In this way only can valuable comparative figures on the revenue and expense accounts be obtained. The operation of public utilities would be especially prejudiced were these lacking, as here more than in any other phase of municipal activity are comparative statements and operating costs and statistics essential.

Again, in municipal accounting, the segregation of items as between revenue and capital is seldom observed by those responsible for the reports issued, with the result that an intelligent understanding of the operations of any period is impossible.

But it is needless to dwell upon what should not be. Let us rather outline briefly some of the more important features which characterize a modern system of municipal accounting.

The main objects to be kept in view are to protect the public treasury and provide at the close of the fiscal year a statement showing clearly the fiancial condition of the city and of its several funds, together with a statement of the year's operations.

To attain these, the first thing to be aimed at is to make the office of the city comptroller a controlling office in fact as well as in name. Its books should control those of all the other departments and the figures shown in total therein should be the aggregate of the detail entries in the books of the departments. In order to achieve this, there must be a strict uniformity of method in and co-operation between the departments. The main source of information in the comptroller's department is, of course, the daily or weekly report from the other departments. Take, for instance, the collection of a tax assessment. The gross amount of the assessment is reported to the comptroller by the assessors. The comptroller charges the tax collector's department with the total amount of that assessment and credits the total amount of collections reported by him each day against it. In the same way any abatements and allowances, after being duly authorized, are credited to the collection department and the balance of this assessment account on the comptroller's books will at all times represent the actual unpaid tax items outstanding on that assessment.

The reports from other departments are all made on the same general principles and the comptroller is thus kept fully informed so that a balance between the departments and the controlling accounts can be effected at any time. The procedure in regard to expenditures should also center in the comptroller's office. No payment should be made or liability incurred without his approval. This policy if carefully carried out reduces the risk of loss through error or dishonesty to a minimum.

The various departments must necessarily keep records for their own use, as well as to comply with the requirements of the city ordinances. The heads of these departments should always have available at the shortest notice the information necessary to enable them to conduct the business of their department in an intelligent and economical way, but the bookkeeping incidental thereto should be reduced to a minimum.

In regard to the collection of revenue, we strongly recommend that this should be handled as far as possible in one office under the charge of an official elected for that purpose. This may at times occasion a certain amount of inconvenience to the tax payer, but that inconvenience is more than compensated for by the additional security and economy effected in the collection of the public funds.

It is impossible, however, in this article, to touch upon more than a few of the points in connection with the organization and internal checking which a proper administration of a city's finances demand. The principal object of it is to impress on those interested the general benefits to be derived from the adoption of a modern system of accounting.

When such a system has been installed and the composite parts are properly working, the first fruits are apparent in the statement of the city affairs which can be produced at the end of the year. This report should consist first of a balance sheet, which will be followed by statements of revenue and expenditure in yearly comparative form.

The balance sheet sumbitted will disclose the financial condition of the city and of its various funds as shown in the comptroller's general ledger. It will be so arranged and classified as to convey a proper understanding of the position to all who read it. Current assets and liabilities will be clearly set forth and the bonded indebtedness shown in such a way as to allow of a ready comparison with the fixed assets by which it is secured. Exhibits and schedules will support the more important items, the details be-

ing obtained from the subsidiary ledgers kept in the various departments.

In the revenue and expenditure account logical arrangement is as essential as elsewhere. Ordinary revenue of the city must not be confused with extraordinary receipts. Sums received from sales of bonds or of any of the city's fixed assets should not be mingled with the year's revenue. In the same way expenditures which increase the capital assets of the city must not be included with the ordinary expenditures chargeable against the year's income.

Statements showing the unexpended balances of appropriations and particulars of the amounts borrowed by the city and the total amount of its debt limit should also be included as part of the annual report.

Various other information may be included in the report, especially in the case of municipalities operating public utilities, when cost and other statistics are naturally called for. So long, however, as the main particulars are adhered to, the minor ones may well be left to the discretion of the council.

Recent events all over the country have shown the dangers of antiquated and inadequate accounting methods. Carefully devised systems are available to those who seek them and the time is, we believe, rapidly approaching when it will be deemed culpable negligence on the part of city officials if they fail to provide proper safeguards for the funds of the people whom they represent, in the shape of adequate control and modern bookkeeping methods.

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## LAYING WATER MAINS WITH PROVISION FOR FUTURE CLEANING.*

*By George F. Whitney.*

THE undisputed formation of tubercles on the interior of cast iron water mains, vegetable growth and sedimentation, make the cleaning of water mains a necessity where they are not replaced by new pipe.

The art of cleaning water mains has been rather dormant in the past, for two reasons: inefficiency and expense; but the art is becoming more fully understood now and the expense is being reduced, so that it seems that in a short time tuberculated mains, or mains filled with vegetable deposit or sediment, will be regularly cleaned so that the cleaning of water mains will be recognized as a regular expense of maintenance, the same as other repair work.

In England it has been the custom for years to lay water mains with frequent openings, so that a cleaning device can be passed from one of these openings to another, and pulled backward and forward, thereby knocking off the projecting tubercles and with subsequent flushing get the dirt out; but, as can be readily seen, the inefficiency of this method is the reason why it has never been adopted generally.

There has also been some work done at Halifax, Boston and some parts of Pennsylvania, but the methods used have either been inefficient or prohibitive in cost.

As the art is sufficiently advanced at the present time and water mains can be thoroughly cleaned, it is time for us to look to the future cleaning of our pipe lines by laying new pipe with special fittings, so as to reduce the cost of cleaning.

Water mains are subject to roughness of the interior and reduction of diameter, due to three causes, namely: tuberculation, vegetable growth and sedimentation. Any one of these three causes reduces the diameter and increases the friction and so destroys the pressure and flow of the pipe, greatly reducing the carrying capacity originally intended. There is hardly any character of water or any location that is entirely free from one of these three causes, while there are many waters in which all three of these contributing causes operate.

Of course, tuberculation is much more rapid in some localities with certain character of water than with others, but I think it is safe to state that no shed water (and I mean by shed water either river water or spring water) is free from either the formation of tubercles, vegetable deposit or sedimentation. Consequently, as the

*A paper before the American Waterworks Association.

conditions can not be avoided, a remedy must be found; so if this premise is correct and the art of cleaning water mains is sufficiently advanced to be efficient, then the future cleaning of water mains must be recognized and provided for.

I think this is all a logical conclusion when the enormous loss of efficiency is considered in tuberculated mains, and I have frequently seen mains cleaned where the increase in flow was from 33 1-3 per cent. to 178 per cent.

It is not necessary to wait until the diameter of the pipe is reduced to one-third or one-half, as the loss is not due so much to reduction in diameter as it is to increased friction. It is well to bring this point out so as to urge frequent cleaning, and in that way keep the pipe line constantly up to its normal and full carrying capacity, and avoid the enormous expense of constantly laying new pipe lines to supply a territory which could readily be supplied if the original line was delivering its normal or full capacity.

Of course, these ideal conditions can never be reached until the expense of cleaning is gotten down to such a figure as will allow the cleaning to be a part of the cost of annual maintenance, and this cannot be gotten at until the pipe lines are originally laid with the idea of future cleaning kept in view.

The greatest expense of cleaning water mains at the present time is the frequent breaks which are necessary in the line, as each one of these breaks means digging, breaking the pipe to put in a special fitting, or a new piece of pipe, and all the skilled and unskilled labor attendant upon such work. These and other things largely add to the expense of cleaning water mains, and if they could be gotten rid of, the cost of cleaning would be so reduced that any water department could well afford to have the cleaning cost added to the cost of maintenance, and not let a contract for cleaning only when it becomes an absolute necessity.

Mr. N. S. Hill, Jr., shows very clearly in a paper read before this association at Toronto, that if mains were cleaned every five years, an expenditure of 2.42 cents per foot per annum would be a conservative addition to the cost of maintenance. I will not take up your time in reading this deduction of Mr. Hill's, but refer you to the proceedings of the association for 1907, page 365.

The additional original cost would be relatively small to what the present contract prices necessarily are, and, in fact, the additional cost would be very small at any rate, as a special fitting or hatch box could be inserted every one thousand feet at very little extra expense.

The perfection of hatch boxes would be one that came to the surface and would require no digging, but that would entail a greater original expense; but a hatch box can be used which would not increase the original expense very materially, but would greatly reduce the cost of cleaning, as a line so equipped would not have to be broken, and that is really the greatest expense incidental to the cleaning of water mains.

Any engineer or superintendent could construct a special fitting to be inserted in a new pipe line at regular intervals of about one thousand feet, which would not only allow the cleaning to be done at a minimum cost, but would also provide means for him to at any time open his line and see the inside condition of the pipe.

If these specials were used it would make the cleaning of water mains a joy to the contractor, and so reduce the expense of cleaning that it would not have to be seriously considered.

Another factor to be considered in the laying of water mains with a view of future cleaning is the economy of time of operation.

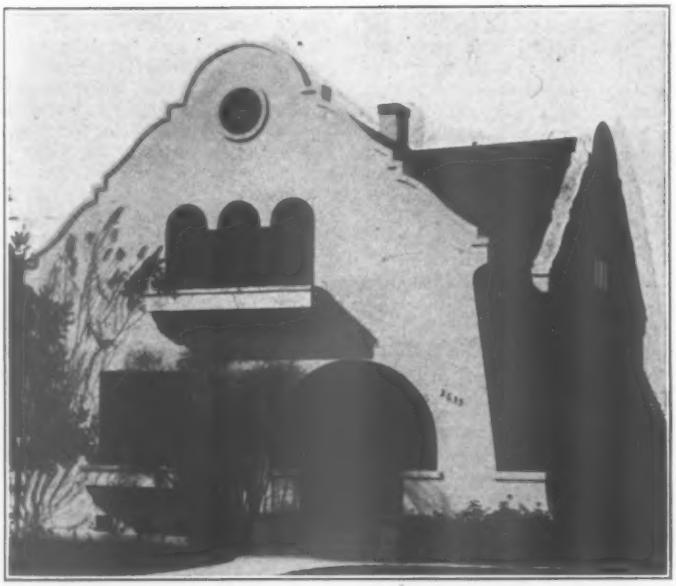
At present, the minimum time the water is shut off for cleaning purposes is four hours, as the pipe has to be broken, special fittings or a new piece of pipe inserted after the machine has been put in the pipe, and then the actual time of cleaning, whereas, if the line was equipped with specials, the only time required to have the water shut off would be the actual time of cleaning, which is about forty-five minutes to every one thousand feet.

This would have a two-fold value: First, economy of time that the water would be shut off from consumers, and second, reduction of fire risks. Of course, at present, as soon as the specials are inserted in a pipe line, water can be put on the entire line within five minutes, but, while the line is broken for the purpose of putting the specials in, the water is necessarily shut off from that section.

If water mains were regularly cleaned and kept free from any and all roughness on the interior, there would be nothing but the normal friction to overcome, and the saving in fuel would probably be sufficient to

pay for all cleaning. In one case which I am familiar with, the pumps were running 117 pounds water pressure before the line was cleaned, whereas, after it had been cleaned, the pumps were run at 109 pounds water pressure and delivered the same amount of water. It has been estimated that from 30 to 50 per cent. more fuel is required where the main is tuberculated, than where the main is free and only the normal friction has to be overcome.

I have given much time and thought to the subject of cleaning water mains, and I am convinced that as the art is brought each year to a higher point of perfection it is bound to become a part of the annual expense of maintenance, and that tne future will show the necessity of laying water mains with a view of frequent cleaning.



CONCRETE HOUSE IN LOS ANGELES, CAL.

# EDITORIAL COMMENT

**Tests of Culvert and Sewer Pipe.**

**The Electric Railway Amusement Park.**

**The Educative Work of the Forest Service.**

## TESTS OF CULVERT AND SEWER PIPE.

A material addition to our knowledge of the strength of pipes to resist external pressure is made by bulletin 22 of the engineering experiment station of the University of Illinois, written by Prof. A. N. Talbot, in charge of the work.

Several sets of experiments upon the resistance of vitrified and concrete pipe to crushing from outside pressure have been described in MUNICIPAL ENGINEERING, and the results have been given. These results have been applicable mainly to pipe in sewer trenches in ordinary good soil. The series of experiments described in this bulletin is upon pipes of reinforced concrete and of cast iron intended for railroad culverts. The stress to which pipes may be subjected in this service is much greater than is probable in sewer service, but the tests are so made that conclusions regarding behavior of pipes under ordinary sewer conditions can also be drawn.

It is evident that the method of supporting the pipe on the bottom of the trench, the side restraint by the undisturbed sides of the trench and the material tamped in about the pipe, the quality and condition of the material, disturbed and undisturbed, in which the pipe lies, and the kind of material and manner of placing in the trench above the pipe, will each have much influence upon the amount and direction of the pressure upon the pipe and the resulting amount, direction and character of the resistance of the pipe to deformation under the stress. In practice, therefore, the stress on a pipe in a sewer trench may vary from zero, when the soil is such that it supports itself in the trench, to that due to the pressure of a liquid equal in weight to the earth above the pipe.

The 1908 "Beton Kalender" gives two formulae for the effect of dead load and of live load on sewer pipe based on certain assumptions. The dead load of earth on the pipe increases with the depth according to the ordinates to a parabola with its vertex 16.4 feet below the surface, and its axis horizontal, i. e., dead load per square foot equals 83 times the depth minus 2.54 times the square of the depth. The effect of live load, due to loads passing on the surface over the trench, decreases with the depth according to a similar law, which would make the effect zero for depth greater than 16.4 feet, i. e., the effect of live load per square foot on pipe equals the load on the surface plus 3.72 times the square of the depth minus 122 times the depth. The total load effect is taken, not as the sum of the two, but as the sum of that of the live load and of two-thirds the dead load.

In a communication to *Engineering Record* Mr. Samuel D. Bleich recommends for the total effect the sum of the dead load and twice the live load effect as conforming to the American practice in treating such loads.

The question of bedding of pipe is quite as important as that of loading. Both are taken up in Professor Talbot's report and discussed mainly with reference to the possibilities of variations in direction of stress, which would affect the location and amount of reinforcement in reinforced concrete pipe. There is no attempt to determine the probable stress from dead or live load on pipe in the trench. The discussion of bedding of pipe shows theoretically the effect of improper bedding in concentrating the supporting pressure upon a line or small area, such as the bell, and the consequent reduction in the amount of weight which the pipe can carry safely.

Culvert pipes in railroad work are likely to have light cover, and when this is true the influence of the live load is predominant. Cast iron culvert pipes have been crushed when located in deep fills, but this is attributed in the report to high loads produced by loose rock used in the fills in some cases. The computation of these loads is beyond the range of the formulae given above. Their amount can be judged by studying the

results of Professor Talbot's tests for complete bedding of pipe, for defective bedding, which concentrates the pressure on small areas of the pipe, and for careless filling, which subjects pipes to lateral and irregular strains which they were not designed to resist.

The conclusions drawn from the experiments are valuable because they call attention to the effect of variations in conditions and the necessity of care in construction to keep the conditions uniformly the best, as well as for the statement of the general conformity of the results with those derived by theoretical computations. They are as follows:

"From the tests and the discussions it would seem evident that among the facts brought out are the following:

"1. The cast iron rings broke under a concentrated load at a calculated modulus of rupture 25 per cent. less than the modulus obtained from rectangular test pieces cut from the rings. The average value of the modulus of rupture for the ring tests was 27,000 pounds per square inch, and it should be noted that this value was obtained with an excellent quality of iron.

"2. The cast iron pipe loaded in sand broke suddenly at one end or the other, finally breaking through the entire length of the pipe. Upon failure the load dropped materially and there was little further strength to the structure. The stiffness of the bell affected the deflections and acted to prevent a uniform distribution of stress throughout the length of the barrel. The presence of the bell adds to the difficulties of securing a uniform distribution of the load, and detracts from the strength of the pipe.

"3. The plain concrete rings broke under slight deflections at loads which agreed well with the calculated strength, both under concentrated load and distributed load. In the testing box under the restraining lateral pressure these rings held high loads after the segments had been deflected considerably from their original position, finally breaking by crushing of the concrete.

"4. The reinforced concrete rings in the concentrated load tests held their maximum loads or about their maximum loads through a considerable deflection, thus showing a quality which is of value when changes in earth conditions permit a gradual yielding of the surrounding earth. The calculated restraining moment agrees fairly well with the calculated bending moment.

"5. The reinforced concrete rings and pipes tested under distributed load made a satisfactory showing. The so-called critical failure may occur by either tension failure in the steel or a diagonal tension failure (ordinarily called shearing failure) in the concrete. A flattened arc for the reinforcement where it approaches the inner face is of assistance and stirrups may be of some value. Beyond the critical load the reinforcement is of service in distributing the cracks and in holding the concrete together. Final failure is by crushing of the concrete in much the same way as was obtained with the plain concrete rings. The additional strength beyond the critical load may be taken into consideration in selecting the factor of safety or working strength.

"6. The restraint of the sand in the tests is very important, and the effect is to reduce the bending moment developed by a given vertical load, or, as it would be commonly stated, to add strength to the pipe. The degree of permanency of this side restraint is uncertain. It seems evident in these tests that the distribution of the pressure, both horizontal and vertical, was not uniform, and that with the usual method of placing a pipe in an embankment, and especially when other materials than sand are used, the distribution would be even less uniform than here found. In view of this it will be well, in making calculations and designs, to use the formula 1-16 *Wd* for the bending moment, thus considering that the side restraint is offset by the uneven distribution of the load, any surplus from this being considered merely an additional margin of safety. For pipes poorly bedded and filled a larger bending moment than 1-16 *Wd* should be used.

"7. The method of bedding and laying pipes and the nature of the bed and the surrounding earth have a great effect upon the bending moment developed and upon the resistance of the pipe to failure. If the method of laying, or the hardness of the soil below, or the condition of the settlement of the pipe is such that the pipe is supported only or mainly along an element of the cylinder at the bottom, the bending moment developed will be greatly increased over that of a uniformly distributed support. If the greatest supported pressure comes at points well to the side of this bottom element, as may be obtained by care-

ful bedding, the bending moment is reduced. It is also plain that the bell should be left free from pressure at the bottom. It is possible that the presence of the bell detracts from the strength of the pipe. Any action in filling which increases the lateral restraint against the pipe will add to the security of the structure."

## THE ELECTRIC RAILWAY AMUSEMENT PARK.

The central states, in which the growth of interurban railways has been most extensive, have a new social problem in the amusement parks which are a prominent feature of many such railroads. The earliest development of out-of-town electric lines was as extensions of city lines to reach points to which large city travel could be induced by offering amusement features, and not too far away so as to discourage the seeker for a few hours' recreation on account of time required in transit or cost of the same.

When actual interurban roads were constructed such parks were for some time thought to be a necessary part of the profit-making apparatus of the company, and if natural attractions or private or public parks under satisfactory management were not available the railroad company established them. Conditions vary, and therefore problems are different and must be carefully studied, and with the best of intentions mistakes are often made. Thus one of the early interurbans tried to make one park do the work of two, and established it about half way between a large city and a small one, some ten miles from each, with a 25-cent round-trip rate. The large city was supplied with similar parks, reached by a 5 or 10-cent fare, and failed to visit the new park after the novelty wore off, while the distance and consequent fare reduced the attendance from the small city below the paying point, even when that city had no other outdoor amusement ground.

A recent number of *Public Service* gives a series of illustrated descriptions of amusement resorts operated by electric railway companies, some of them city lines and some interurbans. These articles show the general character of the various classes of these parks and the ordinary kinds of amusement furnished in them.

Some cities have several different kinds of such parks within reach. One, for example, has a White City, with no attractions other than the various shows which group themselves under that name, a 4-cent fare, with transfers, being required to reach it, and another park with water privileges and the White City aggregation, requiring a 5-cent fare without transfers. The latter, notwithstanding the far greater attractions in country, forest and water, is scarcely able to keep open, while the former is flourishing. Apparently the controlling difference is the cost of reaching the places. Still a third resort is a city park, about the entrance to which an amusement company has grouped a number of the ordinary catch-penny shows. A fourth resort is an electric railway park, whose natural features are more than usually attractive and are interfered with by very few of the noisy sensation producers. Then come several city parks with no such accessories. In most of the latter parks band concerts are given at frequent intervals. There are thus amusements and out-of-door resorts suited to all tastes.

There is a social problem connected with these amusement resorts which is beginning to demand attention. The expense of keeping up the railway parks and their amusements is large, and often the parks are expected to pay their own expenses, and, if possible, bring something into the treasury. If the parks are under private control, whether indirectly connected with the railroad or not, they are operated for the purpose of profit. In too many cases the desire for profits leads to the supply of amusements which are questionable in their character, or of opportunities equally questionable if not most carefully conducted. The demand of a considerable proportion of the young people for sensations is met by these parks and the desire grows with what it feeds upon. It is an outgrowth of the natural desire to get out of the city streets and into touch with some form of nature or its imitation, and has been misled by that with which it has happened to come into contact.

The city park has as its mission the supply of the nearest approach to nature which is possible in and close to the city under the necessary conditions of concentration in certain areas easily reached by the street railways, but restricted by inability to wander at will through private grounds. Park authorities have found long ago that the supply of the place and its control are not sufficient. The crowd needs

some amusement, and gradually the parks have been adding to the amusements furnished. But they have not added them fast enough and the white cities and electric parks have drawn away many of those who most need the better class of amusements. The city parks have done well to refuse room to the empty sensation producers, but they can do much to turn the sentiment of the young toward the quieter enjoyment of life and away from the dangers accompanying the unrestricted indulgence in unusual physical sensations, however innocent they may be in their individual appearance. There seem to be some objections, arising from our system of city government, to the supply of such amusements at a price, but many cities are unable to supply funds to operate them without cost, and the difficulty in making the show pay its own way without opportunity for some one to make a dishonest profit is less important than the supply of the opportunity for the young people to find a really innocent and at the same time attractive place of amusement. The real difficulty is in choosing the character of the amusement features, so that they will be educational in their tendency and at the same time capable of drawing all those for whom they are intended.

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## THE EDUCATIVE WORK OF THE FOREST SERVICE.

The Forest Service of the United States Department of Agriculture is one of the departments of the government which is making use of modern methods in getting its work before the people. One or two other departments, more or less scientific in their methods, have made some use of the newspapers in showing what work tney have done and trying to create public sentiment in favor of the work they desire to do. A very large share of the work of the Forest Service, if it is to have any material effect upon conditions, must be in making more public the present alarming conditions with respect to our supplies of timber and wood for various purposes and the serious difficulties there are in the way of the renewal of forests when they have been denuded and the refuse left a prey to fire and weather. This development of public sentiment is necessary because the sporadic attempts of newspapers and a few farsighted scientists in the past have had little effect in stopping the wholesale destruction of trees without reference to their value as timber in the future, except the establishment of a few thousand acres of forest reserves in the mountains of the West, which was the cause of the establishment of the Forest Service Office as the nucleus of the present organized effort to secure a proper treatment of the vast problem of the future timber supply of this country.

Timber preservation is one of the subjects treated in several circulars. The character of the forests and of the remaining trees is under careful and thorough study, and the drain upon them year by year, with changes in the nature of this drain, are also fully shown in bulletins in the nature of census reports. A practical bulletin gives suggestions to wood-lot owners in the Ohio valley about their importance and the methods of managing them to secure the best results. The necessity of Appalachian forest reservations is shown by bulletins on the relation of these mountains and the water supplies from them to inland water navigation and water power. Something like a hundred of these bulletins, prepared by expert scientific men in the service, are issued in a year.

But in addition to these bulletins by the expert scientists, the service makes use of expert newspaper men, who prepare short articles for the press which put interest into the details, empnasize the fast-waning value of the forests of the country, show the value of the methods of forest management which have been introduced, and the urgent need of the methods of forest preservation and renewal which are advocated by the department.

Gradually, perhaps even rapidly, as the present movement gathers force, the public must come to a realization of the crying necessity of concerted action upon a large scale, and at great expense, to repair the egregious errors of the past, and the Forest Service is deserving of all the help that can be offered in extending its efforts in this direction.

# THE QUESTION DEPARTMENT

### Ordinance Governing Sewer Connections.

We have come to the point in our sewer experience where it becomes necessary to adopt some rules and regulations governing the tapping and making of connections with the sewers. We have an old ordinance relating to the Second street sewer, but as that was first intended only as a storm water sewer, the ordinance is not sufficient. We would be glad to have your suggestions along this line.

FRANK D. JOHNSTON,
City Clerk, Aurora, Ind.

In MUNICIPAL ENGINEERING, vol. xxxii, p. 91, will be found a form of sewer ordinance and also a set of rules and regulations for the contractors and plumbers making sewer connections. This ordinance is comprehensive enough to cover the work in large cities and can be reduced somewhat in complexity for application to the smaller cities and towns, as local conditions may require. The principle of expert supervision of the work should be retained.

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### Books on Cost of Concrete Sewer Construction.

I would like to obtain some data and information on the cost of concrete sewer construction. Inform me of what books treat on concerete sewers. D. O'DAY,
San Francisco, Cal.

The book containing the most information on this subject is Gillette and Hill's "Concrete Construction, Methods and Cost" ($5). It gives both methods and cost of construction for several examples. Buel and Hill's "Reinforced Concrete" ($5) gives some additional examples of reinforced pipe and monolithic sewer construction without cost figures, and Taylor and Thompson's "Concrete, Plain and Reinforced" ($5), gives two or three other descriptions of sewers in concrete, also without figures of cost. There are descriptions of several concrete sewers and conduits in MUNICIPAL ENGINEERING, such as Wilmington, Del., Indianapolis, Ind., Newark, N. J., St. Joseph, Mo., Knoxville, Tenn., etc., which can be supplied at 25 cents each.

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### Fixing Hydrant Rentals.

Will you kindly send us a table showing the cost of hydrant rentals paid in different cities of the United States? We have the question up with us here now and are getting as much information on the subject as is possible. We would like to get the rates per hydrant in as many cities as possible of about 10,000 to 15,000 people.

JNO. M. BUSH,
Secretary Water Works Committee, Ironwood, Mich.

Lists of hydrant rentals in groups of cities will be found in MUNICIPAL ENGINEERING, vol. xiii, p. 220, and vol. xv, p. 235. Following are those of a few cities between 10,000 and 15,000 population taken from the "Manual of American Waterworks" ($5), which is not very full on this point. M indicates municipal and P private ownership. Where two prices are given for hydrant rental the first is usually for a stated number and the second for additional hydrants.

Anniston, Ala., P., $50.
Ft. Smith, Ark., P., $60.
Pasadena, Cal., P., $50.
Ansonia, Conn., P., $28 and $16.
Manchester, Conn., P., $60 and $25.
Cairo, Ill., P., $35.
Champaign, Ill., P., $30.
Kankakee, Ill., P., $44.
Lincoln, Ill., P., $42.50.
Jeffersonvile, Ind., P., $56.
Ft. Dodge, Iowa, M., $71.
Waterloo, Iowa, P., $37 and $40.
Hutchinson, Kan., P., $68.
Baton Rouge, La., P., $51.
Auburn, Me., M., $40.
Augusta, Me., P., $18.
Bath, Me., P., $40.
Waterville, Me., P., $40.
Hagerstown, Md., P., $45.
Attleboro, Mass., M., $30.
Framingham, Mass., P., $40.
Leominster, Mass., M., $39.
Melrose, Mass., M., $14.
Revere, Mass., P., $50 and $40.
Southbridge, Mass., P., $28.
Westfield, Mass., M., 0.
Weymouth, Mass., M., $19.
Woburn, Mass., M., $20.
Adrian, Mich., P., $83.
Alpena, Mich., P., $80 and $40.
Ann Arbor, Mich., P., $45 and $40.
Flint, Mich., M., $65 and $50.
Manistee, Mich., M., $98.
Menominee, Mich., P., $50.
Pontiac, Mich., M., $40.
Traverse City, Mich., M., $73.
Mankato, Minn., M., $35.
Stillwater, Minn., P., $57.
Natchez, Miss., P., $50 and $45.
Hannibal, Mo., P., $58.
Webb City, Mo., P., $50.
Anaconda, Mont., P., $100.
Helena, Mont., P., $91.
Berlin, N. H., P., $40.

Bloomfield, N. J., P., $30.
Hackensack, N. J., P., $35.
Corning, N. Y., M., 0.
Dunkirk, N. Y., M., $143.
Hudson, N. Y., M., $16.
Little Falls, N. Y., M., $46.
Ogdensburg, N. Y., M., 0.
Ashtabula, O., P., $45.
Marion, O., P., $45 and $30.
Massillon, O., P., $37.
Guthrie, Okla., M., $50.
Dubois, Penn., M., $35.
Mahanoy City, Penn., P., $2.
Steelton, Penn., M., $34.
Sunbury, Penn., P., $30.
Corsicana, Tex., P., $95.
Laredo, Tex., P., $45 and $25.
Ogden, Utah, P., $75 and $60.
Rutland, Vt., M., 0.
Beloit, Wis., P., $68.
Manitowoc, Wis., P., $49 and $40.
Wausau, Wis., M., $54.

It is evident from the range of these prices that population of city has practically nothing to do with hydrant rental. The charge for fire protection of a city should depend upon the cost of supplying water and pressure, and the extra cost of the larger pipes and higher pressure frequently necessary, and wholly chargeable to the fire protection. This may well be in the form of a general charge for a certain area and service and an additional charge per hydrant for extensions, or it may be made a uniform charge per hydrant in many cases. The principles upon which the fixing of hydrant rentals should be based and suggestions of methods of determining hydrant rentals in particular cases are considered in MUNICIPAL ENGIENERING, vol. xxiv, p. 182, by D. H. Sawyer, and in an editorial on the same subject on p. 189 of the same number. There is also an article on the same subject in vol. xxiii, p. 185.

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### Books on Harbor and Dock Improvement.

I would be pleased to receive a catalogue of books or papers treating on the improvement of harbors, docks, etc.

J. B. M., Oakland, Cal.

There are very few books on this subject. The only modern books are Cunningham's "Principles and Practice of Harbor Engineering" ($5 net), and Veron-Harcourt's "Harbor and Docks," in two volumes. Stevenson's "Design and Construction of Harbors" is an older book. Some treatment of the subject is given in Vernon-Harcourt's "Civil Engineering as Applied to Construction," and in Spon's "Dictionary of Engineering," parts 39 and 40 and supplement parts 7 and 8. Humber's "Modern Engineering," in four volumes, each £3, 3s, gives examples of engineering works as designed and constructed. The second, third and fourth volumes contain descriptions of docks and piers.

### Salt Water Supplies—Electrolysis.

I am very desirous of obtaining some information regarding the various pipe installations for the use of salt water and the success of the same. I would appreciate any information which you can give me along these lines. Also any information which you may have reference to at hand regarding the electrolysis of piping and the tests made for the same.

S. A. R., Chicago, Ill.

The city of New York is installing a salt water supply as an auxiliary to its new high-pressure fire-protection service. As it is intended for use when the fresh water supply is lacking and has not yet been in use no report of its success can be made. The only other proposals to pump salt water for any municipal purpose known to the writer are those at Oakland and San Francisco, Cal., concerning the installation of which there are no recent reports.

Concerning electrolysis, valuable information can be obtained from articles in MUNICIPAL ENGINEERING, a list of which will be found in vol. xxxii, p. 19. There are also two articles on "Electrolysis in Reinforced Concrete" in vol. xxxiii, pp. 111 and 183.

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### Articles on Asphalt Technology.

Veuillez bien me renseigner sur les meilleurs articles techniques relatif aux pavements en asphalt et sur leur technologie. Pouviez vous me les fournir?

HENRI LAROZA, M. and E. E.
Lima, Peru.

MUNICIPAL ENGINEERING has published many articles upon asphalt pavements and their technology, from which the following list of some of the more important is selected:

In vol. xxxiv: "Kentucky Rock Asphalt Macadam," p. 258.

In vol. xxxiii: "Improving Asphalt Pavements in Kansas City, Mo.," p. 394.

In vol. xxxii: "Sheet Asphalt Pavements," p. 155.

In vol. xxxi: "The Municipal Asphalt Plant at Hamilton, Ont.," p. 354.

In vol. xxx: "Information About Paving Materials," giving full specifications for asphalt pavement, p. 352.

In vol. xxix: "Factors in Asphalt Paving Construction, Maintenance and Cost," p. 203; "Effect of Water Upon Asphalt," pp. 287, 300; "Specifications as to Effect of Water Upon Asphalt," pp. 325, 370; "Effect of Gas on Asphalt Pavements," giving references to a number of previous articles on this subject, p. 429.

In vol. xxviii: "Effect of Oil Upon Asphalt and Bituminous Macadam Pavements," giving also references to previous articles on the solvent action of ethylic alcohol petrolene, oil residuum, maltha, heavy petroleum oil, etc.

In vol. xxvii: "Mixture for Asphalt Pavement," p. 184; "Specific Heat of Asphalt," p. 22; "Effect of Heat Upon Asphaltum in Paving Mixtures," p. 5.

In vol. xxvi: "Modern Methods in As-

phalt Paving,' p. 303; "Specifications for Asphalt Pavements," giving those in use in Washington, D. C., p. 360.

In vol. xxv: "Wear and Quality of Asphalt Streets," giving a list of articles on this subject, p. 90; "Articles on Asphalt Pavements," p. 253, giving a list of general articles on the subject; "Use of Asphalt in Running Water," p. 177.

In vol. xxiv: "Information on Asphalt and Asphalt Paving Work," giving titles of previous articles on technology of asphalt pavements, p. 275; "Information About Rock Asphalt for Paving," giving list of sources of information on rock asphalt, p. 361. These lists are too long to repeat here.

The fact is that nearly every number of MUNICIPAL ENGINEERING contains articles on some phase of asphalt paving and the magazine has published the fullest discussions of all the technical questions arising in connection with the specification and use of asphalt for paving, and a full set of the volumes of the magazine would be necessary to give one all the information the magazine contains. Richardson's "The Modern Asphalt Pavement" ($3) gives full discussion of the subject with special reference to Trinidad asphalt, taking up the technology of asphalt and also of the asphalt pavement. Tillson's "Street Pavements and Paving Materials" ($5) devotes considerable space to the asphalt pavement. Less complete treatment will be found in Baker's "Roads and Pavements" ($5) and Byrne's "Highway Construction" ($5).

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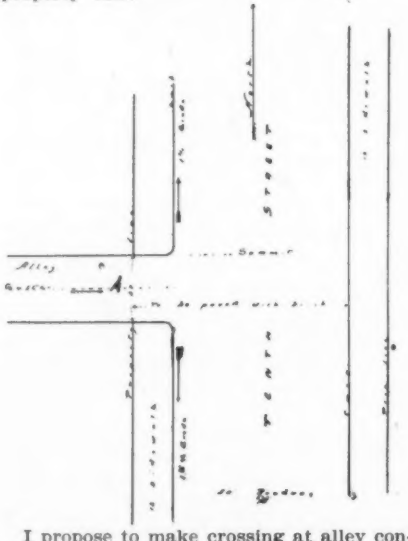
**Design of an Alley Intersection.**

Herewith I enclose a diagram of part of 10th street to be paved with brick from curb to curb and at alley intersection, to property line.



I propose to make crossing at alley concave, to conform to shape of latter, which carries water in the middle. Others contend that this crossing should have a crown like a street, letting water split at A, going north and south on west side of street. I make summit of street grade on line with north side of alley in order not to crowd the 1 per cent. gutter flowing north, but use the better facilities for getting rid of water afforded by steeper grades to the south.

J. A. W., Lexington, Mo.

The question is largely one of convenience and should be solved with reference to the interest most benefitted, and the possibility of joining with pavements already constructed. If the elevation of the alley at the property line of Tenth street is fixed, it may settle the whole matter, for, if the alley intersection is to be crowned, it must conform with the elevation of the center of the street, and must change from crown upward at the gutter, to concave upward at the property line without giving any chance for water to flow back to the property line or any chance for water to stand near the center of the alley east of the property line where the cross section flattens out in its process of change from convex to concave. On the other hand if the alley intersection takes the concave form as at the property line, it flattens out to fit the gutter grade at the gutter line and there is the least possible difficulty in forming the surface, and the flow of the water will be interfered with the least.

With respect to travel on the sidewalk, the form convex upward throws the gutter to the side and makes a step from the sidewalk down to the alley surface. The form concave upward throws the sides higher and makes little or no step at the point of maximum travel along the sidewalk. The water flowing down the center will not be spread out as much as if the attempt is made to turn it from the center of the alley at or near the property line to the sides at the gutter line.

If the alley is not yet paved, it may be suggested that the alley pavement be crowned throughout, but this would not be feasible unless watertight curbs were put in to keep the water out of basements, if there are any adjacent to the alley.

With respect to drainage the water should be turned north or south according to the sewer or drain facilities. Other things being equal, it is best to turn it south with the steeper grade, but if this would over-load a sewer the water can be turned north by moving the summit on Tenth street to the other side of the alley. If the alley intersection is crowned, made convex upward, the summit should be made opposite the center of the alley.

With respect to vehicle travel. If there is much travel from the street into the alley and return, the crowned alley intetrsection would be the more favorable, as the concave form would make a gutter for the travel to cross. If the travel along the west side of the street is the greater, the concave form of the alley in-

tersection will be the better because the convex form would put a crown in the way of the gutter which vehicles traveling along the west side of the street must pass over.

Is the street a populous business street that must have a pavement 54 wide? If it is a residence street or is but little used, the pavement need not be more than half as wide, say 27 to 33 feet.

### Books on Electric Railways.

To the list of books on electric railways, given in the June number of MUNICIPAL ENGINEERING, vol. xxxiv, p. 364, should be added Marks's "Finances of Gas and Electricity Manufacturing Enterprises" ($1), which considers such industries from the statistical and financial standpoint and has one chapter directly applicable to electric road operation.

### Cement Experts and Engineers.

The undersigned is interested in a large property containing deposits of limestone and shale suitable for the manufacture of Portland cement.

Numerous reports satisfactory to the present owners have been made upon the property, but additional ones are desired by parties in this city who are considering the financing of the project.

In their behalf I am in search of a man who will visit the property, make a reliable investigation and furnish a trustworthy report. He must be a man familiar with raw material values—competent to pass upon mill plans and specifications and be experienced in the operation of a Portland cement plant.

L., Pittsburg, Pa.

Names of the best men in this field will be found in the "Business Directory," printed in each number of MUNICIPAL ENGINEERING under the headings "Cement Plant Designers," "Cement Testing," "Cement Chemists," "Chemical Tests."

### Effect Upon Paint of Cement Mortar Joints in Brick Work.

Kindly let me know what experience you have had with cement mortar joints in brick, work when pointed. I am informed that when cement is used, or in combination with lime, for brick work, afterward to be painted, that the paint on the mortar joint fades out, no matter what the color, but especially red, and makes a very ugly job. What do you know about this? Any information on this subject will be appreciated. J. D. C., Uniontown, Pa.

Cement seems to have a bad effect upon paint, producing a chemical action which makes the paint fall off. This does not occur always and the effect seems to wear off. By some chemists the effect is attributed to free lime in the cement. If this is true the effect would disappear when the free lime has been changed to carbonate or other combination and is washed out or fixed. Lime mortar when old enough does not act upon paint. Waterproofing with silicates or Sylvester's process should prevent the chemical action if one cannot wait for time to produce the necessary chemical change before painting.

Will readers report their experiences with painting concrete and painting brick walls with cement mortar joints or pointing?

### Where to Buy a Rattler for Testing Paving Brick.

Please inform us where we can buy a rattler for making a test of vitrified brick according to the specifications of the National Brick Manufacturers' Association.

W. G. R., Louisville, Ky.

Names of makers of standard rattlers, who have them in stock, are given in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings, "Brick Testing Machinery," "Paving Castings," "Standard Rattlers," "Testing Machinery." They include Tinius Olsen & Co., 500 N. 12th St., Philadelphia, Pa., described in MUNICIPAL ENGINEERING, vol. xxxiv, pp. 301 and 378; and The Portsmouth Machine and Casting Co., Portsmouth, O., vol. xxxiv, p. 316.

It is understood that they may also be obtained on order from the Luce Engineering Co., St. Louis, Mo., and Riehle Bros., Philadelphia, Pa.

### Ornamental Concrete Work.

I would like to get information in regard to lawn fountains constructed of cement or concrete. J. D. B.,

Cedar Rapids, Iowa.

The basin of a fountain is similar in general in its structure to a concrete sidewalk in that the base and the mass are of concrete made of coarser materials and the surface is of finer materials and richer mixture. The design having been made by an architect or other expert in ornamental concrete construction, forms can be made for the parts requiring them and the concrete placed in these forms. The methods of making the mixtures, the proportions and the methods of manipulating concrete in forms are described in the "Handbook for Cement Users" ($3). Methods of finishing the surfaces of the concrete are described in three articles in MUNICIPAL ENGINEERING, vol. xxxii, pp. 177, 179 and 181. Information about methods and cost of making molds and forms will be found in Gillette and Hill's "Concrete Construction, Methods and Cost" ($5). There is a little English book on "Artificial Stone" (25 cents) which gives some instruction, and there are several German books on the subject. The "Cement Worker's Handbook" (50 cents) also contains a little information which is applicable in this case.

### Effect of Clay on Cement Mortar.

Will you kindly refer me to the different articles that have appeared in MUNICIPAL ENGINEERING for the past two or three years relative to the results of experiments showing the effect of the addi-

tion of small quantities of clay to Portland cement mortar, i. e., how it affects the strength, time of setting and permeability of the same.

SUBSCRIBER, New Castle, Pa.

The following articles give information on this subject:

"Concrete Aggregates," vol. xxx, p. 116.

"Use of Lime in Concrete Blocks," vol. xxx, p. 359.

"Mortar Sand," vol. xxviii, p. 146.

"Quality of Sand for Concrete," vol. xxviii,, p. 301.

"Impervious Concrete," vol. xxvi, p. 352.

"Concrete Foundation and Cement Filler for Brick Pavement," vol. xxvi, p. 183.

"Concrete Masonry with Special Reference to the Use of Natural Bank Gravel," vol. xxvi, p. 186.

"Water Tightness in Concrete," vol. xxv, p. 445.

"The Handbook for Cement Users" ($3), also contains the results of experiments by Professor Sherman, J. C. Hain, E. K. Coe and C. C. Huestis, in which an increase in strength is shown on the addition of proportions of clay up to 15 per cent.

An article elsewhere in this number gives the most recent results and the theories regarding the action of clay in concrete.

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**Sewer Franchises.**

What have you published on the subject of franchises for companies to supply sewers for the citizens of a town or city?

J., ————, Ind.

The question of sewer franchises, rates charged and methods of conducting private sewer contracts have been discussed in some detail in earlier numbers of MUNICIPAL ENGINEERING. A full descriptive list of the articles will be found in vol. xxv, p. 380. Rates charged are given in xxii, p. 94 for Atlantic City and Asbury Park, N. J., in Telluride, Colo., in vol. xi, p. 372, in Canon City in vol. xxiv, p. 138. Articles discussing provisions of franchises and decisions on validity of franchises will be found in vol. xiii, p. 93; vol. xiv, p. 98; vol. xxii, pp. 253, 382 and 387; vol. xxiv, p. 301.

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**Books on Gas Manufacture.**

I would like a list of books on gas manufacture.

E. K. M., Pierre, S. D.

Following are names of some books on gas manufacture, most of them English:

Butterfield's "Chemistry of Gas Manufacture ($3.50).

O'Connor's "Gas Engines; pocket book ($3.50).

Burns's "Illuminating and Heating Gas" ($1).

Newbigging's "Handbook for Gas Engineers and Managers" ($6.50).

Brown's "Directory of American Gas Companies" ($5).

Marks's "Finances of Gas and Electric Light and Power Enterprises" ($1).

Colyer's "Gas Works, Their Arrangement, Construction, Plant and Machinery" ($5).

Zimmer's "Mechanical Handling of Material ($10.)

Richards's "Coal Gas, a Practical Treatise on Manufacture and Distribution ($2).

Thwaite's "Gaseous Fuel" (75 cents).

Burns's "Gas Manufacture ($1.50).

Hughes's "Construction of Gas Works" ($4).

Latta's "Handbook of American Gas Engineering Practice" ($4.50).

Lewis's "Modern Retort Settings, Their Construction and Working" ($1.50).

Hole's "Distribution of Gas" ($4).

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**Cost of Operating Municipal Lighting Plants.**

We are anxious to get a report on the cost of operating municipal lighting plants in different cities in the United States. If you have such a list, will you kindly send same, rendering invoice for the amount. Or if these reports have from time to time appeared in your magazine, will you kindly send me such copies as refer direct to such reports.

N. C. K., St. Louis, Mo.

In 1899 what is now known as the U. S. Department of Commerce and Labor published a detailed report on gas, electric and water plants, which gives much information upon this question. The information is anonymous, however, and may not be satisfactory on that account. Our correspondent is doubtless familiar with the annual reports of the Massachusetts Board of Gas and Electric Light Commissioners which give such information regarding plants in that state. The reports of similar boards recently instituted in New York and Wisconsin give data from which similar statements can be made for plants in those states.

A list of recent articles in MUNICIPAL ENGINEERING, giving information concerning various cities, will be found in vol. xxxiv, p. 300 (May number). Other classified lists of articles are given in vol. xxix, p. 96, and vol. xxvii, p. 200. These articles gives the results in cost of operating per lamp, and few of them give any figures of total operation and total receipts. Comparisons are easiest made by reducing to the cost per lamp, but one interested in the actual operation of a plant must for published figures go to the national and state reports mentioned for the greater detail he will probably desire.

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**The Sun Portland Cement Co.**

Referring to the Sun Portland Cement Co., noted in your 1906 edition of Directory of Cement Industries. Will you kindly advise how long this plant has been running? A. W. M., Detroit, Mich.

The report of the Bureau of Mines of the Province of Ontario for the year 1902

states that the Sun Portland Cement Company's plant is approaching completion. The edition of the "Directory of American Cement Industries for 1902" ($5) mentions the company and its engineer and reports the failure of the company to send in statement. The edition for 1904 reports the company to be manufacturing cement and that for 1906 gives full data regarding the plant. The company began the manufacture of cement in 1902, using the dry process, and changed to the wet process in July, 1904. Cement was made from the same materials in the same locality by other companies by various processes a number of years before the Sun Company's plant was completed, the first company having been organized in 1889.

# FROM WORKERS IN THE FIELD

**Practical Points from Practical People.**

**Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.**

### Cement Macadam Streets in Germany.

Cement macadam has been used in Kottbus, Germany, since 1898 with success in streets of small area and of medium to light traffic.

The raw material for these streets is the debris of the bed of diabase at the quarry of Koschenberg. The diabase is a dark green granular stone composed of white to faint green colored feldspar, black crystallized augite, frequently black biotite in separate little layers, also occasionally magnetic iron ore. For some years this stone has been used as street surfacing and for the manufacture of pressed paving stones, for which its exceptional hardness and toughness make it specially valuable. Diabase shows greater resistance than other hard stone to the influence of the weather. Careful selection of sizes of broken stone, thorough washing and thorough mixture of the different screen sizes and the method of laying, are also important elements in the success of the pavement.

The reports of the department of public works of Kottbus give the method of construction and the results. The report is abstracted in *Beton und Eisen*, from which this account is taken.

The thickness of the cement macadam in all these streets is 20 cm., (about 8 inches) of which six inches is in the bottom layer, the foundation concrete, and 2 inches is in the wearing surface. The grade of the cement macadam driveways is from 1 in 300 to 1 in 50. The latter should be considered the limit for cement macadam.

In the first pavement, in order to avoid slipping and sliding of carriages and horses, which is so markedly unpleasant on asphalt streets, a cross slope of 1 in 50 with a crown was used. This showed that a stronger cross slope could be used, up to 1 in 40 with a parabolic curve.

For the foundation grauwacke, a further product of the Koschenberg quarry, is used, on account of the saving in cost and because it can be used to make a good base, where the wearing qualities are not important. The wearing surface demands the exclusive use of diabase, which demonstrates its value both by its thorough combination with the cement and its resistance to the wear of the traffic. First-class Portland cement is an essential.

The foundation layer is made of a thin mixture of grauwacke, the wearing surface of a rich mixture of the green-stone concrete. The stone is broken in a machine.

After the laying of the borders the grade is completed and turned over to the contractor. The usual border used in Kottbus is about 5 inches broad at top and 14 inches deep, and was formerly made fast only with props, but is now filled in behind with a thin gravel concrete. Bismarck street had a soft subgrade and was first given a layer of grauwacke, which was tamped down 6 inches thick. Longitudinal cracks appeared in this street after a year, and measurements showed that settlements of the subgrade had occurred notwithstanding.

Then the foundation layer of the consistency of moist earth is filled in 18 c.m. thick and tamped with heavy tamps to a thickness of 15 c.m., then rolled smooth with a stone hand roller. A mixer is used for the concrete in this layer. After the foundation layer is two or three

days old the wearing surface is put on. This is now constructed after the Jantzen patent. Two I-beams spanning the street are fastened together, one under the other, at about 32 inches distance and their ends run on rollers on two rails of wood. By means of clamps, which have a distance one below the other of 30 inches and screw spindles through them, a form made of strong plates about one meter long, is freely suspended from the I-beams and can reach the whole breadth of the street. Under this form the concrete for the wearing surface is tamped sidewise in strips about 6 inches wide lengthwise of the street, while the form is moved along by means of a windlass and chain. The concrete for this course is carefully mixed by hand. The tamping of the moistened mass of concrete is done with an iron tamp rounded on the lower end and sliding on a smooth plate. Behind the form the wearing surface appears with its proper profile. The cement mortar collected on the surface is worked smooth with surfacer, trowel and brush, so that slight pits may be worked out.

The tamping under forms has marked advantages over the old methods. Insufficiently tamped spots show themselves clearly; the surface receives exactly the desired profile; unevenness, especially shallow depressions which are inseparable from tamping from above, are not possible. The concrete is equally well tamped and the individual stones are pressed close together by the hard sidewise tamping.

On the first construction in West street, Kottbus, the tamping was done directly from above without the form, and it showed more deficiencies and flat places to bring up to grade by subsequent corrections.

The cost of the diabase cement macadam using the forms is 8.30 marks per square meter, about $1.51 a square yard, including a 5-year guaranty to replace any defects which may appear. It is estimated to be two-thirds the cost of asphalt.

The Kottbus streets laid with cement macadam are West street in 1898, 3,200 square meters, 11 meters wide; Bismarck street in 1899, about 1,800 square meters, 9 meters wide; Promenade street in 1901, about 2,500 square meters, 7.3 meters wide; Bahnhof street in 1902, 1,100 square meters, 10 meters wide; Kaiser Wilhelm Platz, about 1,900 square meters, 6 meters wide; Jahr street in 1904, 1,052 square meters, 5.5 meters wide; Market place in 1904, about 864 square meters; street at the castle in 1904, 590 square meters, 5 meters broad.

There are also the "Grosse Weg" in the Tiergarden in Berlin, 1,055 square meters, 7.5 meters wide, laid in 1904; and Malteser street in Breslau, 1,208 square meters, 10 meters wide, also laid in 1904.

In noiselessness the cement macadam approaches asphalt and wooden blocks. Only the stroke of the horses' shoes sounds clearer.

The production of dust is less on the cement macadam than on asphalt streets, but on account of the even and impervious surface is somewhat greater than on ordinary pavements. There is the same necessity of keeping the pavement clean.

With dampness and in dirty weather cement macadam is less slippery than asphalt. With ice, as on asphalt, it is necessary to spread sand.

There is a test area in Landes street in Vienna where several systems of paving are under test, two brick, with cement and with tar fillers and one of basalt concrete.

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### How to Make Cement Lined Water Pipe.

The city of Plymouth, Mass., was visited by the New England Waterworks Association on June 24. One of the points of interest was the manufacture by the water department of cement lined water pipe. All the water mains of the town, 49½ miles, are cement lined pipe. The first were laid in 1855. The association had the opportunity of inspecting the manufacture of the pipe and the laying of an 18-inch supply main near the pumping station. The following description of the method of manufacture of the pipe was furnished the visitors:

Cement lined or jacket pipe, so-called, consists of an inner shell, a jacket or outer shell, two cast iron rings (a male and female), a neat cement lining inside the jacket and a neat cement grout or filling between the jacket and shell.

The shells and jackets are received at the shop in flat rectangular sheets of the proper size. The shells are of varying gages from No. 20 to No. 13 gage according to the following schedule of sizes of pipe to be made, while the jackets are No. 26 gage for all sizes of pipe:

| | |
|---|---|
| 4 inch pipe | No. 20 gage |
| 6 inch pipe | No. 19 gage |
| 8 inch pipe | No. 18 gage |
| 10 inch pipe | No. 17 gage |
| 12 inch pipe | No. 15 gage |
| 14 inch pipe | No. 13 gage |
| 16 inch pipe | No. 13 gage |
| 18 inch pipe | No. 13 gage |

The shells are punched and rolled into cylindrical shape by machinery and riveted by hand, after which the male ring is fitted into one end and the female ring into the other.

They are then lined with cement, in sizes above 12 inch by hand and in the smaller sizes by means of a revolving cone. After the lining has had sufficient time to harden or set, usually about 24 hours, the pipes are stood on end around the edge of a platform and the jackets, which are punched, rolled and riveted in precisely the same manner as the shells are fitted over them.

The jackets when rolled and riveted are

about 1½ inches larger in diameter than the shells, so that when they are placed around them there is a space of about ¾ inch all around between the shell and the jacket. This space is kept uniform by means of wedges at the top and a clamp at the bottom of the pipe. Liquid cement grout is then poured between the shell and the jacket.

After remaining in the shop 24 hours longer the pipes are scraped and cleaned with cement and painted with tar paint, after which they are allowed to harden about two weeks before being carted to the trench.

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### How to Build Concrete Steps.

EDITOR MUNICIPAL ENGINEERING:

Sir—You have been asked in vol. xxxiv, p. 356, under the head of Question Department, how to build concrete steps.

Your correspondent says the contractor has had no experience in this line. He says the steps are to be 30 feet long between buttresses, 16 risers, treads 13 inches, with a finish coat of 1 to 2 mortar 1 inch thick. He was told to begin at the bottom, making one step at a time and place the finishing coat the same day.

Now this is all right so far as it goes, but if I were going to build such a flight of steps I should ask to be allowed to build and finish them in a certain way. As they are generally finished they look as though they were made of putty. I have built a good many and seen a good many that others have built, and in nine times out of ten they show the same trouble on the risers, that is, black hair lines. This puts them out of favor with me, and is owing to the manner in which they are finished after the forms are taken down.

The only way to overcome this difficulty in my mind is to bush hammer the work after the same is fully seasoned. We always give ¼ inch grade to all treads. While it costs something to do this, it prevents the putty look and does away with the black lines. I have treated steps in this way in a few cases and with success.

There are two ways to build concrete steps and the only two that I will have anything to do with.

One is to build the buttresses first and on a solid foundation. Then to build the steps on a reinforced center, running up the bank with a concrete fill not less than one foot thick at the weakest point, which is at the junction of the tread and riser. One should commence building steps at the bottom and finish the top the same day.

Another way is to excavate the whole mass of earth, build the buttresses on a solid foundation and then after filling the space in solid with concrete, build the steps up one at a time, finishing as you go along. If this is done and the steps are then bush hammered you will have something that will not look like putty, but like hammered granite, will not show hair lines, will not be troubled with frost and will last till "kingdom come."

I have built concrete steps for fifty and sixty thousand dollar houses, but now when I am asked to do such a piece of work I object until I explain the manner in which they should be finished and what may happen if it is not done.

If this contractor has a set of concrete steps to build for a nice library, he has my idea of how they should be built. I may be fussy, but I talk to my customers just as I write and feel.

GEO. H. SMARDON, Portland, Maine.

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### Wire Glass Fire Windows.

EDITOR MUNICIPAL ENGINEERING:

Sir—Considering the magnitude of the national fire loss, it would seem, in the natural order of things, that materials and devices for guarding against losses could be administered upon, in a manner to better encourage the co-operation of architects, engineers and owners. In this connection we must allow that the work of fire insurance organizations has gone a great way in classifying, ruling upon, and putting in print for circulation the better methods of building, in a way to reduce fire losses. There remain, however, exceptions, some of which I believe are of sufficient value to receive comments upon.

With reference to wire glass and fire windows in particular, it has for some reason come to be the custom to associate, in a comparative way, fire windows and fire shutters. The more wire glass is studied and comprehended, especially for fire windows, the stronger becomes the evidence that the capacity of wire glass, as a retardant properly utilized and much more generally employed in building operations, is very much clouded by such an association and comparison.

The standard shutter today is tin-clad wood. The standard shutter, to judge from what we see at all points, ten years ago must have been the sheet-iron shutter. It has been found even recently that there is not a unanimity of opinion among underwriters having jurisdiction upon the fire-clad wood or sheet-iron shutter.

Regardless of whether the shutter is a single or double locked tin-clad wood shutter or a reinforced sheet-iron shutter, the doubt is always uppermost as to whether shutters are properly closed, even if the equipments are uniformly in order. This doubt in the minds of insurance capital and owners extends equally to closed light courts as well as to exposed elevations.

The buildings of today with their elaborate architectural fronts, will not always allow shutters. Hotels, office buildings,

apartment houses and other various buildings are so used and occupied that shutters would be of doubtful value, as they could not be closed nights, as in factories and merchandizing houses.

The modern architecture in iron, masonry and concrete buildings, that abound with large areas of glass, with a choice of rough, ribbed, mazed or polished, between piers and mullions, to secure renting values by an abundance of lights, calls for something better than shutters.

If a fire window was an auxiliary to a common window, same as a shutter, I could better understand this everlasting comparison of one to the other. As it is, the fire window in itself is a window and a retardant fully equal, if not greatly superior to a shutter, and carries of necessity a better guarantee of protection to the spread of fire on account of its being depended upon for protection from weather and cold.

The possibility of fire by transmission of heat through the glass is a means of claiming a preference for fire shutters, and clouding the valuable capacity of wire glass to endure against heat of any intensity and duration, conditional upon one side of glass in question having exposure to the air. Against the transmission of heat into a building to a point of combustion, I can say with a strong conviction of being confirmed by fire authorities that combustion by transmission of heat through glass requires a steadier heat than can be had across an alley or street with attending currents and swirling of wind that logically accompany heat, and that such a danger can be easily anticipated and prepared for by placing inside guards in front of windows so as to keep any merchandise 24 or 36 inches away.

An additional thought on this question of combustion by transmission, worthy of consideration, is that against the area of glass in a room the cubic capacity of room should be considered, for it is an easy matter to embarrass the position of the writer by some one citing a very small room where for lack of circulation the transmission of heat would possibly raise the temperature to a point of combustion.

Considered broadly, the capacity of wire glass to safeguard any city from the spread of fire by intelligent engineering, I beg that its real worth may be more thoughtfully considered and that the supervising work, as to construction of frames and sashes by the Underwriters' Laboratories, may find a response at least at the hands of insurance companies looking for preferred risks.

A very assuring factor in fire window work today is the manufacture of fire windows under the underwriters' tag system. Under the tag system the work is identical to window work in different window construction that has been tested and approved at the Underwriters' Laboratory in Chicago. Every underwriters' window that is tagged has a number that appears on brass plates riveted to frame (commonly called tag). These tagged windows with destination are examined before shipment, and the record, including destination, is recorded both at the Chicago Laboratory and Office of Underwriters having jurisdiction.

There is much more to be said in addition to what I have already offered. As it is, I think it better to wait for an expression of interest on this subject before submitting more.

S. HARRIS POMEROY,
New York City.

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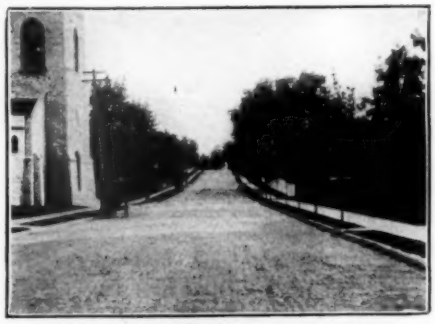
### Coal Tar Pitch Filler.

EDITOR OF MUNICIPAL ENGINEERING:

Sir—The subject of bituminous fillers for the joints in brick and block stone paving is receiving considerable attention in the trade papers, the articles appearing in behalf of so-called oil asphalts. To my mind these articles create an entirely erroneous idea as to the qualities necessary and the advantages of bituminous fillers.



WINSLOW AVENUE, CINCINNATI.
**Pavement filled with Barrett's Paving Pitch.**

A filler to give satisfaction must first of all bind the bricks or blocks tightly together so as to give a continuous waterproof surface that will prevent water from passing through to the foundations. It must also take care of the expansion and contraction of the blocks themselves incident to changes in temperature. The question of protecting the top edges of the bricks or blocks is only incidental, as there is comparatively little wear at these points where a good quality of brick or stone is used, and that little is a great aid to traffic, as it gives the horses a proper footing.

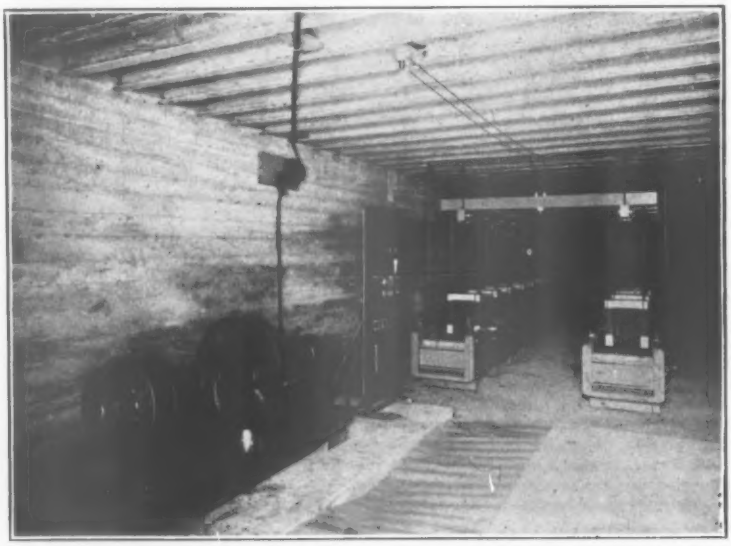
One of the greatest objections to a grout filler is that it makes a continuous slippery hard surface, and this is particularly noticeable on streets having an appreciable grade. A grout filler is also very rigid and does not allow for any expansion or contraction of the pavement, with the result that it soon bulges or cracks, leaving permanent openings through which water penetrates to the foundation.

Theoretically, expansion joints of bituminous material provide for expansion and contraction, but in practice cracks frequently occur and bulging is not uncommon where expansion joints are used. The perfect filler is one that permits all blocks to be set as close together as the lugs or letters will permit, that provides in each joint for the expansion or contraction that may take place in each block, that permits each block to rest entirely on the foundation, that provides a perfectly water-tight pavement at all times of the year and that gives just sufficient roughness to the surface so that horses get a footing.

The only filler that will provide all these conditions is a bituminous filler, and the only one that fulfills all the conditions perfectly is a straight run coal-tar pitch, having a melting point varying not more than 5 degrees either way from 135 degrees. Coal-tar pitch is not only the best, but the cheapest. It adheres perfectly to brick, stone or concrete (curb or gutter), even when applied under unfavorable weather conditions, and bonds the bricks firmly together. Any possible break or joint is only temporary, as on the first warm day the pitch filler closes up as tightly as before. The safe footing is provided for horses, there are no cracks in the pavement and no rumbling hollow sounds because of sections raising from the foundation. Pitch filler also permits of immediate use of pavement.

It is common knowledge that a more sticky material is required properly to adhere to stone or concrete curb than to bricks or block, and as most of the moisture develops in the gutters next to the curb, it is particularly necessary where expansion joints only are used to have material that will insure a water-tight pavement at this point. Engineers should not be confused regarding the value of special characteristics in this or that bituminous material, but should consider only such materials as will serve all the purposes for which it is required and at a minimum cost. Many fillers are expensive, both in material cost and cost of application, while coal tar pitch is readily obtainable the country over at prices averaging less than half those charged for other bituminous materials, and besides the pitch can be applied at a much lower cost.

R. S. C.,
New York City.



ELECTROLYTIC SEWAGE PURIFICATION PLANT AT SANTA MONICA, CAL.

### Electric Purjfication of Sewerage.

EDITOR OF MUNICIPAL ENGINEERING:

Sir—A number of cities throughout the country are watching with considerable interest the success attending the experiment now being made by Santa Monica, Cal., in the installation of a magneto-electrolytic plant for the treatment of the sewage of that city. Being the first plant of the kind in this country, the results obtained in the California city will be a guide to other municipalities in the solution of a problem that has ever proven troublesome. The plant in question consists of a wooden tank equipped with ten electrodes and an equal number of electro magnets, each weighing 300 pounds. The electric energy is supplied by a direct current generator of low voltage and high amperage. The sewage is permitted

to flow evenly through the tank in sufficient volume to cover the electrodes and the magnets to the depth of three inches. The current is turned on as the sewage flows over the wires and enters the outfall pipe. By that time the waste is supposed to be odorless and harmless. What actually happens as the sewage passes through the charged tank has not been scientifically determined, but experiments have demonstrated that as the electric current enters the water in which the sewage is held, the effect is to immediately release the hydrogen; and as the current leaves the water the oxygen is freed, the constituents of water being hydrogen and oxygen. The releasing of the former precipitates all the inorganic matter, and the freeing of the oxygen forms an ozone which is responsible for the burning or oxidation of the organic matter. The result is that the sewage becomes at once purified.

It has been demonstrated that the cost of electric energy for treating one million gallons of sewage, the daily capacity of the Santa Monica plant, will not exceed fifty cents. The plant now being installed will cost $12,000.

C. B. IRVINE,
Santa Monica, Cal.

# STREETS AND PAVEMENTS

## Repairing Milwaukee Streets—Indiana Road Law—Cities Can Abolish Grade Crossings—Municipal Stone Crusher—Pavement on Fire—Improvements in Wood Block Paving

### Milwaukee Streets Cannot Be Repaved Without Majority Petition.

A decision affecting the method of making city street improvements was rendered by Judge L. W. Halsey, at Milwaukee, Wisconsin, June 1. Under his ruling a street cannot be repaved by the city unless there is a petition to that effect signed by a majority of the owners of property on the street. Heretofore the common council, at the suggestion of the board of public works, has ordered such work done in the way of repaving streets as they have seen fit, charging the cost up to the abutting property owners in special taxes.

### New Indiana Road Law is Constitutional.

A decision was handed down by Judge Ira W. Christian, at Noblesville, Indiana, in the case of Samuel N. Smith against the county commissioners in an effort to enjoin them from issuing bonds for the construction of new gravel roads. Judge Christian held the new gravel road law to be constitutional. He said the Supreme Court had passed on practically all the questions raised on this litigation, and he could see no reason for holding the law invalid. Regarding the contention of the petitioner that the three-mile limit clause was unconstitutional, Judge Christian said if it was legal to build a road one or two miles in length by the same process of reasoning it might be extended to five or six miles.

### Right of Cities to Help Pay Cost of Abolishing Grade Crossings Is Confirmed.

The Court of Errors and Appeals affirmed, June 15, the Supreme Court's decision that the city of Newark, New Jersey, must pay the Lackawanna Railroad Company the last installment of $150,000 on the $600,000 which the municipality agreed to as its share of the cost of abolishing the road's grade crossings within that city. After passing upon the constitutionality of the act of 1901, under which the agreement was executed, the opinion takes up the question as to whether the city officials were justified in making such a contract. Regarding this, Judge Vredenburgh says:

We take judicial notice of the fact that Newark is a growing city, with a constantly expanding population and traffic, and that a large number of trains must be required to be run on the railroad tracks over the grade crossings there. This must constitute a constant menace to the lives of its citizens, and fully justified, in our opinion, its municipal authorities in taking advantage of the aid and authority of the statute in the execution of an enforceable contract between the city and the railroad companies in order to guard against such dangers.

Without the action of the railroads in elevating and depressing their tracks at these grade crossings, and the concurrent action of the city in vacating the right of the public in the streets and highways involved, the relief from such dangers designed by the statute could not have been afforded.

To accomplish this object and to obtain this relief, the agreement in question be-

came necessary. The mutuality and interdependence of the several undertakings of the contracting parties to each other under this agreement is apparent upon an examination of its very voluminous terms. The intent of the parties to the agreement to make the structures a permanent improvement to the city, and, as far as possible, ornamental to the locality where placed, is evident from the specifications of the expensive materials required to be used and the elaborate work to be done. For its share of the cost of these important works and extensive changes, the city covenanted to pay the companies upon completion a total sum of money, including the amount now in controversy. We think the agreement was within the capacity of the city to enter into by force of the statute cited, and was not in excess of its corporate powers.

The payment of a recognized moral obligation assumed for services rendered has been held repeatedly by this court to be within the legislative power, and its discharge does not constitute a donation of the public funds.

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### Municipality Can Run Stone Crusher Only for City Uses.

A decision was rendered by the Wabash Circuit Court, at Wabash, Ind., June 19, holding that a municipality may own a stone crusher and manufacture crushed stone if it is for use in repairing or improving streets for the city. The city, however, has no right to own a stone crusher for commercial purposes, crushing stone for sale to other parties or private enterprises.

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### A Street Pavement on Fire.

The street paving liquid in a caldron caught fire, at Ardmore, Pa., June 19, and the flames, reaching the newly-laid surface of Greenfield avenue, set it on fire. For half a block the street was a sheet of flame, enveloping the houses in a cloud of black smoke. The nearness of an immense gas tank to the fire caused considerable excitement. The flames were extinguished by the workmen, who dug up sand and spread it over the highway.

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### Improvements in Wood Block Pavements.*

BY F. A. KUMMER, NEW YORK CITY.

Six years ago the man who approached the average municipal engineer with a proposition to lay wood block was regarded very much as the average business man would regard a dealer in gold bricks; and even a leading engineering journal took occasion, in an editorial, to point out that the introduction of wood block pavements in the United States would prove a very hard row to hoe, with little prospects of success. Today the most famous street in the world is laid with wood block, and it would appear that the pavement had so demonstrated its good qualities that it has come to stay.

Without entering very deeply into the general question of the manufacturing and laying of wood blocks, with which you are doubtless more or less familiar, I would say that in the inception of the wood block idea in the East there existed two sources of information and experience upon which the engineer could draw in his efforts to find the best. One of these lay in English and continental cities where wood block had been successfully laid for many years upon streets of the heaviest travel. Engineers and laymen speaking of these pavements, as a rule, referred to three general conditions: First, that the English pavements were better because they were laid on excessively heavy concrete foundations, running in some instances up to 12 inches in depth. This statement I have had made to me within the past month by the mayor of a large and progressive city, and yet it is certainly the better engineering construction to lay foundations of no greater depth than the conditions require, and if 4 inches or 5 inches or 6 inches of concrete is amply sufficient to carry the loads passing over the street, what could be gained by increasing the concrete depth and also the price of the pavement to no purpose? It therefore became apparent that wood pavement required no greater depth of concrete than any other form of pavement, and that this depth in accordance with the practice of most American cities was quite sufficient for the purpose at hand.

The second prominent feature which was brought forward in connection with the foreign pavements was the use of hard woods from Australia, known as the Karri and Jarrah woods. It was found upon investigation that these woods were by no means used in the majority of instances abroad, that they were laid untreaded, were open to the serious objection of at least a portion of the blocks decaying, and made a paving surface so hard and slippery that horses with difficulty obtained a foothold on them, unless the pavement was constantly sprinkled with sand or crushed stone. On the other hand, the laying of such soft woods as Norway pine, either dipped in creosote oil or treated with about 10 pounds to the cubic foot, did not seem to be a scientific solution of the wood-paving problem, and it became evident that better results would be obtained from long-leaf yellow pine, which, while harder than the Norway pines, is still not so hard as to be unduly slippery and is susceptible of complete treatment with preservative material, by

*Abstract from a paper before the Municipal Engineers of New York.

which is meant a treatment throughout the entire mass of the block.

The third fact which an investigation of these pavements brought forth was that the blocks were almost universally laid with a joint of from one-half to three-fourths inch between them. Why this practice was adopted I do not know, unless it was with the idea of allowing untreated or insufficiently treated blocks to expand, but this could hardly have been the case, because these joints and the surface of the pavement itself was so liberally filled and covered with paving pitch and gravel that the resulting pavement resembled very much a tarred roof through which no water could readily penetrate. This method of laying the block, especially with Australian woods, provided a better foothold for horses, because the joints of the block rounded off under travel, producing a sort of cobblestone effect. This method of laying was also discarded in investigating the subject, and it was decided to lay long-leaf yellow pine blocks, thoroughly treated throughout, on a concrete bed of moderate depth, with tight joints, the block being so filled with a preservative material that water could not enter and cause expansion, and for this reason no joint was used between the blocks other than fine, dry sand. It was also thought, and events have proven it correctly, that the rate of wear of Georgia pine properly treated was so small from year to year that blocks of a moderate depth of 4 inches would be sufficient for the most extreme conditions, and this has since been reduced to 3 1-2 inches, and in some instances 3 inches. The English practice, on the other hand, was to use blocks 5 to 6 inches deep, and in some cases even more. It is with some satisfaction that we note that the English practice is now being modified, tending to the use of a shallower block laid with tight joints.

After securing this information from the foreign practice, the laying of wood block in the western wart of the United States, notably in Indianapolis, was looked into, and here it was found, while Georgia pine blocks on 6 inches of concrete, 4 inches deep and laid with tight joints, were successfully resisting wear, they had in many instances swelled badly and were almost universally laid with a heavy pitch expansion joint along the curb to obviate this difficulty. The absorption of water by these blocks was due to two causes: First, insufficient treatment, and second, treatment with ordinary commercial creosote oil. This, it was believed, could be remedied by increasing the amount of treatment from 12 to 14 pounds per cubic foot to 22, and combining with the creosote oil some highly waterproof material, such as melted rosin, to seal up the pores of the wood and prevent both the absorption of moisture and the leaching out of the oil. It was on this basis that wood block pavements in the East were first laid, and their success was very great.

We now come to some of the problems which have complicated the question in recent years to such an extent that unless they can be solved the use of wood pavements could hardly be very extensive. These problems were partly of a commercial and partly of a technical nature. They involved, first, the increasing price and the decreasing quality of the long-leaf yellow pine available for the manufacture of paving blocks. Second, the enormous increase, amounting to several hundred per cent, in the cost of rosin. These are both commercial questions, but they brought in their train a very large number of technical questions, the solution of which has not been easy. Ten years ago the average manufacturer of long-leaf yellow pine in the South would use every effort to obtain an order for 1,000,000 feet or 2,000,000 feet or more of all-heart, long-leaf yellow pine, cut from the best part of the tree and of very superior quality. Today there is not a lumber manufacturer in the United States to my knowledge who would accept such an order, and only at very high prices can lumber of good quality be secured. It is a well-known fact, for instance, that the density of yellow pine between the lower and upper parts of the tree varies as much as 30 per cent, and yet today the lower and larger parts of the tree are being used for large-sized timbers, while the smaller and less dense parts are being cut into paving-block stock or material of a similar small dimension. Then, too, the exclusion of sap wood in the lumber has become and is daily becoming more and more difficult. These conditions would result either in the production of a paving block so costly that it could only be used on the most heavily traveled and luxurious streets, or in the production of a block which would be inferior in quality. Neither of these results were in any way desirable, and it therefore seemed evident that manufacturers of paving block must find a substitute for long-leaf yellow pine to avoid these conditions. The United States Government has also taken a very lively interest in this question, and through their suggestions, as well as through those from other sources, it was concluded that one of the gum woods, existing largely in the South and known as black gum, possessed all the requirements for successful use as a paving material. This wood, on account of the difficulty in preventing it from warping, and

other inherent qualities, has been used very slightly for general purposes. It resembles the Australian hard woods above referred to, but, while very dense in grain and tough, is not so hard as those woods and not so proof against decay. It was felt, however, that, properly treated, it would make a block, if anything, superior to Georgia pine, and actual tests in service indicate this to be the case. Blocks of this character have been laid on Hudson Street, from Dominick to Watts Street, between the tracks of the Metropolitan Street Railway Company, and are standing up under heavy travel, if anything, better than pine adjoining them in the same location. This wood possesses the great advantage of running uniform throughout and is unlike yellow pine in that it does not have the great difference in durability between sap and heart wood. I believe it will prove a most desirable and valuable addition to the timbers available for paving-block purposes.

Returning to the question of the treatment, the advance in the price of rosin from $1.40 to $4.70 per barrel naturally suggested the use of another material, if another could be found equally good, or a reduction in the amount used, provided this reduction could be made without decreasing the quality of the product. Great difficulty has been found in obtaining any material which will take the place of rosin as a material for waterproofing and hardening the blocks. Asphalts and pitches will not mix with creosote oil, so that their use is in this way prevented, nor have they the advantage of hardening the fiber of the wood. A thorough investigation of the subject led to the conclusion that the only way in which the amount of rosin could be reduced would be by improving the quality of the oil. Creosote oil is generally tested for its gravity and also for its volatilizing points. By increasing the gravity of the oil and greatly reducing the amounts that evaporate at given temperatures, a far heavier, denser, and more permanent oil may be secured, and with the use of such an oil the amount of rosin may be safely cut in half. These statements are made advisedly, and are the result of long and continued experimentations, both as to the possibility of securing thorough treatment with oils of this character, and especially as to the waterproof qualities of the resulting product, and it has been found that blocks treated with oils of this character, containing only 20 to 25 per cent of rosin, are if anything, more waterproof than blocks treated with the lighter creosote oils with 50 per cent of rosin.

These results lead to the very gratifying conclusion that manufacturers of wood block can produce a pavement inferior in no respect to those which have been laid in the past, and, if anything, in some respects superior, which they can safely guarantee under the heaviest travel, without being obliged to ask for block prices so high as to become prohibitive.

In speaking of these questions, I have not made any reference to the method of treating paving blocks. If this is not well known to you all, it is sufficient to say that the blocks, after being cut to size, are placed in circular cages made of band steel of approximately the diameter of the cylinders in which the treatment takes place, and are in these cages then run into the cylinders on cars. The cylinders themselves are usually about 6 feet in diameter and somewhat over 100 feet long, and are provided with steam coils along the bottom and sides to provide heat for drying and preparing the lumber for treatment. The blocks are heated up in this way, some works employing live steam instead of steam coils, and others a combination of the two, and after several hours, both by the use of heat and by the use of a vacuum pump, a large portion of the moisture and light volatile oils, if any, in the wood are driven off, after which the preservative material is run into the cylinder under a vacuum and hydraulic pressure of 200 pounds per square inch applied from 2 to 3 hours, or for such longer period of time as may be necessary to thoroughly treat the charge, this result being accomplished when the gauges show that no more material is entering the wood.

The question of the proper joints to use between wood paving block is one which has received a good deal of attention. Like many cases of a similar nature, it is impossible to generalize and say that any one form of joint is the best for all conditions. On streets where the travel is heavy, the blocks are laid close together and the action of travel tends to expand the head of the block slightly, resulting in the closing up of the joints, so that the surface of the street is almost as homogeneous as the surface of an asphalt street and no crevices for the entrance of water exist. No wood block pavements will be affected by the water which runs over their surface, both because this water quickly flows to the gutter, if the street is properly graded, and because the surface of the block under travel becomes so dense and hard that they will not absorb water. Where water, however, can run under the block through the joints and remain for many days in the process of being soaked up by the pavement, expansion sometimes takes place, even with the most thorough treatment, this expansion resulting more from the character of

the wood than from the character of the treatment itself. It has therefore been found that on streets of light travel where the traffic is not sufficiently heavy to cause this unification of the surface, either some form of waterproof joint should be used or else expansion joints to take up any possible expansion of the block should be provided. In the Borough of Queens last year some 50,000 square yards of block were laid on streets of very moderate travel in this way. Half-inch expansion joints were left along the curb and along the rails on streets with car tracks. These joints were filled with No. 4 paving pitch. Similar joints were placed across the street at intervals of 100 feet. It is very gratifying to note that, not only has there been no evidence whatever of any swelling on these streets, but it does not appear that the expansion joint has been brought into play, as I have not been able to discover any evidence of its squeezing out, as would have been the case had the block expanded. This would seem to indicate that its use in this instance was unnecessary, but it is a precaution which I think it wise to take on streets of moderate or light travel.

In some of the western cities expansion of the pavement, especially where blocks of light treatment are used, is prevented by grouting the whole surface with a paving-pitch. This absolutely prevents the entrance of moisture into the surface of the pavement, but is open to a defect so serious that its use in this way is very limited. In spreading melted and hot paving pitch over the surface of a street and brushing it into the joints with squeegees, a certain amount is left on the surface, and under the action of the hot sun this becomes very sticky and disagreeable. In the nature of things, it would be very unsatisfactory to the property owners, because as soon as the pitch gets sticky it is tracked into stores and houses and on to the sidewalks, to the great damage of carpets, etc. In the city of Baltimore some contracts have just been let in which an attempt will be made to pour the joints with paving pitch, instead of spreading the pitch over the surface, but unless the blocks are separated so that the spout of the can from which the pitch is poured can be run along in the groove, my own experience is that very few, if any, workmen can accurately pour joints of this character without getting more pitch on the surface than they do into the joints.

If the pitch is spread over the surface in very hot weather and the greatest care is taken, not only to leave as little as possible on the surface when sweeping it into the joints, but also to put sand over the surface of the street while the pitch is hot, this surface pitch will be ground off by the action of travel within a reasonably short time, but even during that period the complaints from its use will be very numerous. Still another consideration arises in the case of these joints, which may not be apparent at first thought. On prominent business streets in this city, if the joints are to be made with sand, it is not practical to leave a coating of sand on the surface of the street long enough for it to work into the joints by the action of travel. This results from the fact that this sand is constantly being blown into the faces of pedestrians and into stores and office buildings, to the great dissatisfaction of the public; therefore the specifications of the city of New York, borough of Manhattan, call for a cement joint between the bolcks, instead of sand. This joint, inasmuch as it is run between the blocks in the usual manner, is very quickly applied, and the surface of the street may be swept clean of the sand top dressing within a short time. In fact, under these circumstances there seems very little necessity of using much, if any, sand top dressing at all, except for the purpose of filling up those few joints which the grout has not thoroughly filled.

In the beginning of the wood block industry in the East, blocks of uniform lengths of 8 inches were called for and have been called for during the past 5 or 6 years. The Western practice, on the contrary, has in many instances admitted blocks running in lengths from 6 to 10 or even 12 inches. I am inclined to believe that this provision is a very wise one, inasmuch as the length of the block has no direct relation to its wearing qualities, and it is possible to more readily obtain a lumber supply with planks ranging, say, from 6 to 10 inches in width than by being obliged to buy all planks of the one width. As far as the depth of the block is concerned, I believe that blocks 3 1-2 inches in depth, of proper material and proper treatment, will be quite as serviceable as 4-inch blocks, as the rate of wear is very small, and either would probably become unserviceable after from 1 to 2 inches of the surface had worn off, and this amount of wear would not result until the lapse of a very long period of time. For decreasing the cost of the pavement on less important streets, 3-inch blocks have been very successfully used, but there are mechanical objections to using blocks of less depth than 3 inches, as they have not sufficient depth to bind them properly into the street.

It has been thought by many people in the past that the constant sprinkling of wood block streets is to their advantage. My own observation is that the constant sprinkling of wood block streets is a very

great disadvantage and greatly reduces their resistance to wear. The reason for this is very evident. If the surface of the street is kept constantly wet and then pounded by heavy travel, the upper fibers of the wood are softened, in just the same way that any other similar material, even stone, is more easily worn away when wet than when dry. Tests made by the United States Government Bureau of Forestry, on the relative resistance of wood to breaking, crushing, etc., when wet and dry, show differences extending in some cases up to 100 per cent., and the presence of moisture in the fibers of wood block will cause it to wear out much more rapidly than if it is kept dry. Warren street, New York, the first street laid in Manhattan with wood block (with the exception of Twentieth street, originally laid some ten years ago with Australian hard wood), was for a long period after it was laid kept continually wet under a private sprinkling contract. Last year this sprinkling was stopped. I made a careful examination of blocks taken from this street, and find in many cases the tops of the blocks, instead of being pounded down and dense and hard, as is the case on streets not so sprinkled, had broomed out under the action of travel and the preservative material mechanically pounded out of the wood by the combined action of the travel and the water. This, of course, leaves the surface of the block unprotected by the antiseptic preservative and ready to decay. It also, in its spongy condition, offers poor resistance to wear. For this reason it would seem very desirable that wood block streets should be sprinkled only so much as is necessary to sweep their surface properly and should be kept clean and free from dust, rather than to depend on the old-fashioned plan of converting the dust into mud by putting water on it. There is no difficulty in keeping wood block streets clean, because, unlike asphalt streets, the wear upon them does not produce a fine dust, and, unlike granite block streets, there are no large crevices or joints to hold dirt.

The mortar bed as a substitute for the sand cushion, used abroad extensively, and first suggested in New York City by Mr. Tillson, chief engineer of highways of the borough of Manhattan, has proved in every way a decided advance over the sand cushion. It will not hold moisture to any appreciable extent, and it cannot shift, and thus always maintains the block in a rigid position. Wood block, being in itself elastic, requires no cushion, as would be the case with stone or brick, but, while wood block pavements have a very long life, if the individual blocks which compose the street are kept perfectly to grade, it is one of the most easily destroyed pavements in the world if the surface becomes uneven, and this can never be entirely prevented where a sand cushion is used.

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### Ore Reducing Works Responsible for Damaged Purity of Water in Streams.

The United States Supreme Court rendered a decision, June 1, in the case of the Western Loan and Savings Company of Utah vs. the Butte and Boston Consolidated Mining Company, involving the question whether ore-reducing works can be held responsible for the pollution of water and the consequent damage to land below. The decision was favorable to the Western Loan and Savings Company of Utah. The company owns a cattle ranch on Silver Bow creek, in Deer Lodge county below the mining company's smelting works at Butte, and the suit presented a claim for damages on the ground that the smelter had filled the stream with pulverized quartz, causing the water to be poisoned by the liberated minerals and to overflow the grass land of the complainant. It was contended that the soil was greatly injured and the water rendered unfit for use.

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### Pennsylvania Water Companies Must Furnish Pure Water.

The Pennsylvania Supreme Court rendered a decision May 26 affirming the judgment of No. 3 court of Allegheny county in the case of E. Z. Peffer and other residents of Wilkinsburg, who brought an equity suit against the Pennsylvania Water Company to restrain the company from furnishing the borough with impure water filled with sewage and discase germs which was held responsible for an epidemic of typhoid fever which spread over the town. Judge Miller, specially presiding in No. 3 court, found for the plaintiffs, and ordered the company to furnish an up-to-date filtration plant and reasonably pure water. The company argued that if it was compelled to put in a new system it would cost at least $1,000,000 and in view of the customers it had it could not do so with profit. Ie was ordered to start work and report its progress to the court every three months, but an appeal was taken which acted as a supersedeas. The effect of the decision is not confined to Wilkinsburg, for it means that every water company in the state which furnishes impure water to its customers can be compelled to erect filter beds or a good system for the people who pay for pure water.

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### New Jersey to Measure Flow in Streams.

Plans for establishing measuring stations in the principal rivers of the state of New Jersey for the purpose of determining to what extend the diversion of water

depletes the flow, were considered June 16 by the State Water Supply Commission. This work was formerly carried on by the State Geological Survey, but was abandoned in 1894. It is the plan of the commission, after establishing the stations and fixing the ratings of the different rivers, to have readings of the instruments made daily by local men and reports submitted monthly, the commission, in this manner, to get an accurate line on the diversion of waters. It is proposed to establish stations on the Passaic and its branches, the Hackensack, Elizabeth, Delaware, Absecon and Rockaway rivers. The commission directed the Hudson County Water Company and the New York and New Jersey Water Company to file separate reports showing the amount of water supplied to each municipalty in place of the present reports which show only the total amount diverted. Maps are also being prepared by the commission showing location of all water companies and their plants in the state. These will be used when applications are made for new or additional water supplies.

# MUNICIPAL AND TECHNICAL LITERATURE

## Public Playgrounds—New Publications—Building Laws—Tests of Columns

### Public Playgrounds for Children.

"American Playgrounds" is a book about to be published through the American Gymnasia Company, Boston. Although the playground movement is arousing national interest, there is no book on the subject. This will be the first. "American Playgrounds" will treat of the construction, equipment, maintenance and utility of such institutions. It will show what is proper provision for the physical welfare of both children and older folks by means of rational physical training, especially out of doors. The book will tell by means of many illustrations and by descriptive and technical chapters what has been and what should be done. It will be a book for those who want general information on the subject and who want to know its relations to other phases of the general work for betterment of mankind; and it will also be for teachers and committees who wish specific suggestions or directions for the management of playgrounds, outdoor gymnasiums, athletic fields, swimming pools and the other features that find favor in modern recreation centers.

### New Publications.

Ventilation of Buildings. By William G. Snow and Thomas Nolan. 85 pp. boards, 50 cents. Van Nostrand's Science Series, No. 5. D. Van Nostrand Co., 23 Murray street, New York City.

This is a new book taking the place of the old book by W. P. Butler with the same title issued with the same number in the series of little books on scientific subjects by this company. There has been great development in the science of ventilation and especially in the methods of artificial ventilation since Butler's book was printed and the substitution of a modern book was necessary. It is of course impossible to go into the details of computation and design in so small a book as this and the authors content themselves with a condensed statement of the general principles of ventilation and their application to various classes of buildings. The first chapter shows the importance of ventilation, the composition and impurities of air, the methods of testing the quality of air, of removing dust, of regulating the proportion of impurities without drafts, gives the scientific and statutory requirements regarding sufficiency of ventilation, spaces allowed per occupant, and also considers humidity, cooling of air, cost of ventilation, methods of testing systems and effect of ventilation on the acoustic properties of halls.

The second chapter classifies the systems of ventilation, shows the purpose of blowers, the principles of the exhaust and plenum systems, methods of drawing out air, the methods of downward and upward ventilation.

The last chapter suggests the systems and methods of ventilation suitable for residences, school buildings, churches, halls, court rooms, theaters, hospitals, asylums, office buildings.

The layman who is interested in the question of ventilation of any of these classes of buildings will find the book interesting and very instructive. The engineer must look elsewhere for what he may want beyond a general view of the subject.

The Disposal of Municipal Refuse. By H. de B. Parsons, Consulting Engineer. 181 pp., cloth, $2.00. John Wiley & Sons, New York City.

The author states in his preface that this book is a collection of his notes upon systems of refuse disposal gathered during his study of the problem of the design of a plant for disposing of certain portions of the refuse of New York City. As this refuse did not include garbage the book does not go far into the question of garbage disposal. One chapter gives the practice regarding classification of the waste materials of a city and such data as have been collected regarding the amounts of each class. Another chapter, fully illustrated with photographs, describes briefly methods of collection, others, equally well illustrated, give some general information about methods of disposal. There is a good chapter on the economics of the processes. About 40 pages is devoted to practical incineration of rubbish, including the plans prepared by the author for a rubbish destruction plant for a part of New York City. One-fourth of the pages are taken up by illustrations, one-fourth by the blank space on the back of the pages containing illustrations, leaving about 93 pages of text. Considering the limitations of space and the limitations of the subject by restricting it to the lines leading to his special study of a particular and partial problem, the author has made a useful book. The purchaser must understand that the title is exact, according to the standard classification of municipal wastes or he may be disappointed in the size and character of its contents.

The Steel Square and Calculating Machine. By Albert Fair. 81 pp. cloth, illustrated. 50 cents. The Industrial Publication Co., New York City.

Mr. Fair's little book is intended to make simple for uneducated men and boys the simple computations possible with the steel square, which he divides into two classes, those involving the principle of the squares on the three sides of a right-angle triangle and those involving proportion. It fulfills its mission very fairly well although its authority is likely to be questioned by the reader who notes that the individual, the accuracy of whose later books is attacked in it, was formerly writing books for the publisher of the present volume and is now in the employ of another publishing firm. The prominence given to a particular maker of steel squares also may be sufficient to give the impression that the book is largely intended for an advertisement.

Problems in Surveying, Railroad Surveying and Geodesy. With an appendix on the adjustments of the engineer's transit and level. By Howard C. Ives and Harold E. Hilts, 147 pp., morocco, $1.50. John Wiley & Sons, New York City.

Prepared for use in the authors' work in their classes in the University of Pennsylvania, this book will be found valuable for those who are not constantly in field work and wish an aid to their memories and a guide to operations with which they do not happen to be familiar. In addition to its value for college and technical school students is its value for the independent student who will find the explanations of methods and the principles upon which they are based sufficiently simple to be followed readily. The forms of keeping notes are particularly helpful.

The various problems set for the student are grouped under the headings of chain, level, compass, transit, railroad surveying, geodesy, astronomy, etc., and the appendix gives methods of adjusting transit and level.

Elements of Sanitary Engineering. By Mansfield Merriman. 252 pp., cloth, $2 net. John Wiley & Sons, New York City.

Professor Merriman seems to have prepared this book originally to fit the time allotted to a course in water-supply and sewerage in the engineering school with which he was connected and it has the limitations as to extent and thoroughness of treatment which this required. He has made an excellent choice of material for such a short course and by means of references to fuller treatments of the various subjects in other books and periodicals, in connection with the problems which he sets at the end of each chapter, he points the way to the principal sources of engineering knowledge of the subjects he touches upon.

In the ten years since the first edition was prepared there have been great advances in many lines and, while there has been some rewriting and some additions have been made in this latest edition, there are some sections which are still imperfect by omission or because they are out of date. Notable among these are parts

of the sections on classification of diseases, bacteriology, organic matter, biological analysis of water, evaporation, run-off and percolation, chemical precipitation, disposal of sewage in rivers, refuse and garbage.

The author practically restricts his definition of sanitary engineering to water supply, sewerage and sewage disposal, the collection and disposal of street refuse and garbage being very superficially treated, and such subjects as plumbing, ventilation and heating, which are in the field of so many self-styled sanitary engineers having bare mention. It is not to be expected that a book of the size and very reasonable price of this one should cover the whole field, but the objection is made to the restriction of the definition of the title. With these few reservations the book is recommended as reliable, accurate, clear, easy to read and to understand.

Proceedings of the Society for the Promotion of Engineering Education. Cloth, $2.50 per annual volume. Engineering News Publishing Co., New York City.

The annual volumes of proceedings of this society, which have now reached sixteen in number are so valuable and the call for them is so frequent that they are now put in position to reach the hands of all who desire them, whether members of the society or not. The publisher is well known and the price is very reasonable.

A Chapter on Lettering, with samples of figures, headings, initials, scrolls and titles. 25 pp., paper. 25 cents. The Browning Press, Cleveland, O.

The amount of text in this booklet is small but is well condensed. Much of the instruction is given in the plates, showing by the actual example of the sentence itself the effect of the faults described. Several sets of plain and ornamental letters are given, some of the plates illustrating the tendency of draftsmen to spell incorrectly and to arrange bizarre letters in bizarre order, difficult to follow. The booklet is unique and shows what styles not to follow as well as giving styles to follow. Some of the fancy letters are not designed in the best of taste, however.

Self-Propelled Vehicles. A practical treatise on all forms of automobiles, by James E. Homans, A. M., Fifth Revised Edition, entirely rewritten. New York, Theo. Audel & Co., 63 Fifth avenue.

New and completely revised, this popular book fulfills the requirements of the motor vehicle owner, operator and repairer.

In his revision, the author has emphasized the practical aspects of motor vehicles of all powers, confining his space to the discussion of matters fundamental in construction and management.

Theoretical matters—important almost wholly to designers and builders—are introduced only where good explanations positively require them, and at no point is the reader's mind burdened with padded material on experimental and obsolete construction.

Recognizing that the gasoline vehicle is the typical automobile, considerable space is devoted to its complete discussion; theory, operation, and an extensive chapter on "Gasoline Engine Management," the latter virtually covering all forms of difficulty liable to occur under service conditions. Anyone reading this chapter can derive an intelligent conception of the requirements for an expert driver, and will find numerous points of information, usually obtainable only by long and varied experience.

All the accessory parts of an automobile, carburetters, igniters, transmission gears, are fully explained by typical examples. The author properly assumes that an adequate knowledge of the principles upon which these devices are constructed will enable the reader to understand variations for himself.

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### Building Laws to Regulate Fire Protection.

At its last meeting the National Fire Protection Association passed the following resolutions:

That a practical means for the conservation of the natural resources of our country is to be found in the restriction of the destruction of property by fire.

That state legislation, where not now existing, should be enacted at an early date, enabling communities to make proper provision for the supervision and control of building construction and installation of adequate fire protection and preventable measures.

That communities already authorized to enact building laws should give their earnest attention to such revision of present ordinances and adoption of new measures as experience has demonstrated to be necessary and advisable.

That buildings where people congregate, such as schools, colleges, theaters, hospitals, asylums, churches, department stores and the like, are peculiarly susceptible to calamitous conditions, and should receive the particular attention of the recognized authorities in the insistence upon superior construction and the introduction of apparatus for the automatic extinguishment of fires.

# ORGANIZATIONS AND INDIVIDUALS

**Engineering Courses—Civic Association Co-operation—California Elections—Indiana Waterworks—Technical Meetings—Civil Service Examinations—Personal Notes**

### Summer Courses in Engineering.

The following courses counting toward the degrees of the School of Mines, Engineering and Chemistry, and the degree of M. A. in the School of Pure Science, open without examination to all students who are qualified, are offered in the summer session of Columbia University, July 7 to August 14:

Civil Engineering: Hydraulics, five hours lectures per week by Professor Adolph Black; Structures, reinforced concrete, five hours lectures per week by Dr. E. P. Goodrich.

Electrical Engineering: Electric train movement, six hours lectures per week by Prof. C. C. Mailloux.

Mechanical Engineering: Gas Engines, six hours lectures, six hours laboratory per week under Professor C. E. Lucke.

Metallurgical Engineering: Metallography of iron, steel and industrial alloys, five hours lectures, five hours laboratory per week under Professor William Campbell.

Also chemistry, drawing, methematics, mechanics, Mineralogy, Physics and shopwork. All these courses will be of special interest to instructors in technical schools, to graduating students and to practicing engineers.

For further information in regard to these courses apply to the Secretary of Columbia University, New York city.

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### Co-operation in Civic Associations.

One of the most striking features of our American civilization, a feature rather unnoted by most Americans, too, is the great number of agencies at work for improved conditions.

All of these agencies have memberships composed of volunteer workers and, in more than a general way, they have a common object. Some of these associations have for their primary purpose a practical educational system for every child; others seek to improve educational advantages for a certain class.

There are associations to enforce legislation restricting child labor, to improve the home environment of hand-to-mouth wage-earners, to protect American birds, to obtain legislation protective of the free ballot, to elevate the government of municipality and state.

When it is considered how general are these organizations and associations, for there is not a community that does not have one or more, surely an inspiration is given to those who view the future of this nation in a spirit of optimism.

It is true that, with associations having a specific and single object, there is a tendency in studying conditions to reach a conclusion that the one specific, single object of a particular association is the greatest need of a community, and that once the improvement in that particular thing is accomplished all other questions will stetle themselves.

In recent years, however, as the aims and activities af various associations and organizations have been found to encroach upon the plans and schemes of other associations and organizations, there is a tendency to co-operate, and eventually this inclination must resolve itself into a purpose to amalgamate. When this shall be done this nation will contain a network of organized effort, a tremendous population of volunteer workers for good.

An example of this idea is given by the National Municipal League, an organization for the purpose of advancing reform in the government of our cities, purely educational and strictly non-partisan. This league has an active membership of 1,500 workers and students of the municipal problems, but what is more encouraging from the viewpoint of results, an affiliated membership, represented in various kindred local associations, which number 115,000, all of whom are directly or indirectly interested in the league's cause.

No student of American politics can consider this force without being impressed with it. It represents right energy, working for the common good. It represents example which is bound to attract others and enlist them in the cause. It represents an agency which is beyond estimating the results, but it is an agency which the greed of bossism cannot overthrow, and, as it continues, it will become the vital force which gradually will minimize the extent of corrupt politics, eventually making the political boss and all his brood the rare exception in public affairs.

**Municipal Elections in California.**

New city officials have been elected in the cities and towns of California as follows:

Alturas—Trustees: B. Lauer, E. F. Auble, I. W. Gibbon, F. Sunnyfrank, C. B. Estes; clerk, J. W. Drane.

Arcata—Trustees: George W. Harpst, H. S. Seeley, E. H. Miller, W. H. Wagner, F. H. Tooley; clerk, J. B. Tilley; city engineer, A. J. Monroe; street superintendent, J. E. Morton.

Azusa—Trustees: V. M. Greener, H. C. Bowers, R. M. Follows, E. R. Jeffrey, John Ott; clerk, G. E. Glover; city engineer, A. B. Waddingham; street superintendent, H. F. Parkinson.

Belvedere—Trustees: George L. Bean, W. H. L. Corran, Fred W. Boole, Charles Paff, Albert Russell; clerk, George D. Kierueff.

Corona—Trustees: A. F. Gillett, E. P. Kidden, A. B. Tuthill, E. B. Callier, H. H. Holmes; clerk, H. A. Wood; city engineer and street superintendent, Robert L. Harrell.

Ferndale—Trustees: H. C. Blum, A. Putnam, G. M. Brice, Jas. Giacomini, C. A. Doe; clerk, G. W. Dungan; city engineer, J. A. Shaw; street superintendent, I. B. Barnes.

Fort Bragg—Trustees: Thos. Kerby, R. C. Gardner, F. Windlinx, Sr., H. Mulson, George Switzer; clerk, W. G. Jones.

Lompoc—Trustees: James Sloan, W. H. Sudden, H. Poland, J. F. McClure, N. L. Spanne; clerk, G. W. Meals; street superintendent, C. A. Reed.

Los Banos—Trustees: J. E. Place, W. T. White, J. D. McCarthy, J. V. Toscano, John Olsen; clerk, Charles Schleef; street superintendent, Thos. Robinson.

Loyalton—Trustees: G. L. Coates, J. S. Wren, F. H. Lake, W. A. Schroeder, W. D. Thorne; clerk, Charles Schleef; street superintendent, Joel L. Webb.

Martinez—Trustees: J. J. McNamara, R. H. Ingraham, J. W. McClelland, T. A. McMahon; clerk, D. M. Kelly; city engineer, E. C. Brown; street superintendent, M. M. Taggart.

National City—Trustees: Charles R. Ogden, Frank Hall, Jas. Fleming, George W. Deford, Daniel Strahl; clerk, George W. Grant; city engineer, O. E. M. Howard; street superintendent, E. F. Regna.

Point Richmond—Trustees: J. B. Willis, I. M. Perrin, Levi Boswell, C. A. Follett, E. H. Garrard; clerk, H. H. Turley; city engineer, H. F. Compton; street superintendent, N. M. Blankenship.

San Anselmo—Trustees: W. E. Jones, W. J. Raubinger, F. J. Crisp, F. P. Ashworth, J. H. Robinson; clerk, A. A. Moore; street superintendent, W. J. Raubinger.

San Jacinto—Trustees: George Grover, L. J. Bentley, Jack Hopkins, Mark Worden, Will H. Sanders; clerk, J. Q. A. Hudson.

San Juan—Trustees: C. F. Bigley, F. W. Kemp, W. R. Moore, A. Taix, Sr., W. S. Haydon; clerk, W. E. Hodges; street superintendent, F. W. Kemp.

San Mateo—Trustees: J. E. Casey, M. J. Conway, C. M. Morse, M. J. Powers; clerk, John D. Morton; city engineer, D. Bromfield; street superintendent, George A. Bartlett.

Santa Paula—Trustees: S. G. Brooks, M. W. Stein, H. H. Youngken, C. E. King, J. W. Richardson; clerk, W. M. Reese; city engineer, T. B. McNamara; street superintendent, W. A. Nichols.

Santa Rosa—Trustees: E. G. Bronson, C. F. Forgett, Aubrey Basham, Fred C. Steiner, L. W. Burris, A. L. Johnston; clerk, C. D. Clawson; city engineer, T. B. McNama; street superintendent, W. A. Nichols.

Sawtelle—Trustees: R. F. McClellan, Wm. Hass, C. S. Maryin, George W. Peck, J. R. Fairbanks; clerk, Roy G. Putnam; city engineer, Thomas H. James; street superintendent, Eugene Burr.

Sebastopol—Trustees: E. T. O'Leary, George Armstrong, Thomas Meagher, Charles Burroughs, G. A. Stout; clerk, H. W. Pierce; city engineer, N. V. Smythe; street superintendent, Eugene Burr.

South Pasadena—Trustees: J. S. Dodge, C. N. Taylor; clerk, Wm. L. Cox.

Susanville—Trustees: Abel Burrell, F. H. Shanks, E. A. Martin, George E. Winchester, A. K. Philbrook; clerk, R. E. Bangham; street superintendent, David Ward.

Upland—Trustees: A. H. Skinner, Geo. Hogg, Josiah Dundas, R. T. Nelson, Kirk Vernon; clerk, R. C. Norton; city engineer, B. B. Mann; street superintendent, J. E. Ketchson.

Vacaville—Trustees: W. S. Killingsworth, G. A. Arnold, A. M. Stevenson, C. J. Uhl, W. B. Parker; clerk, E. W. Manuel; city engineer, F. A. Steiger; street superintendent, M. Cline.

Benicia—Trustees: C. J. Daly, J. B. Johnston, A. McKay, W. L. Crooks, J. DeForest; clerk, C. D. Scannell; street superintendent, W. J. Harnett.

Fortuna—Trustees: M. C. Poyfaire, J. W. Dixon, E. W. Haight, F. P. Newell, R. R. Smith; clerk, Fred C. Mills; city engineer, G. W. Connors; street superintendent, H. A. Hansen.

Gridley—Trustees: J. N. Hollis, R. A. Norman, C. A. Moore, E. Fagan, T. B. Channon; clerk, Fred G. Moesch; city engineer, J. L. Potter.

Imperial—Trustees: B. R. Chaplin, Asa Dickey, George H. Reid, J. B. Brackett, C. W. Fernald; clerk, H. N. Dyke; city engineer, John T. Rice.

Mayfield—Trustees: Victor Dornberger, Stephen A. Ponce, Peter Towne, Jos. R. Mesa, A. B. Clark; clerk, W. H. Myrick; city engineer, C. M. Barker; street superintendent, D. W. Harden.

Modesto—Trustees: J. M. Pike, Chas. E. Rice, C. A. Post, A. N. Brown, J. R. Broughton; clerk, Walter O. Thompson; city engineer, George H. Freitas.

San Jose—Mayor, C. W. Davidson; councilmen: A. L. Whitman, Dan. J. McGrath, J. S. Carey, Theo. Brohaska, Walter C. Matthewson; clerk, Roy E. Walter; city engineer, C. H. Peiper.

San Luis Obispo—Trustees: E. W. Clark, A. Lucassa, P. J. McCoffrey, L. Alberts, R. Leland; clerk, W. J. Miles; city engineer, George Story; street superintendent, C. W. Long; water superintendent, E. A. Branch.

Sausalito—Trusfees: Jos. V. Silva, L. C. Pistolesi, F. D. Lensley, J. Thomas, C. P. Shoemaker; clerk, John E. Kipp; city engineer, A. E. Roberts; street superintendent, L. C. Pistoles.

Selma—Trustees: R. E. Stevens, J. W. Hudson, Joel H. Smith, W. C. Freeland, R. G. Wildey; clerk, R. C. Gibbs; city engineer, W. H. Shafer; street superintendent, Oliver Ingram.

San Leandro—Trustees: J. J. Gill, L. J. Toffelmier, C. L. Redeout, F. H. Eber, J. M. Santana; clerk, J. W. Harbert; city engineer, C. H. Goodwin; street superintendent, M. Geisenhofer.

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### Conference of Indiana Waterworks Men.

The Indiana State Board of Health has invited the owners and managers of the municipal and private waterworks plants of Indiana to a conference to be held in the state capital at Indianapolis July 8 and 9, to study the sources of water supplies in Indiana, their preservation and purification, and to establish standard and uniform methods of analysis.

The sessions will begin with the usual welcoming and opening speeches and a short business session at 10 a. m., Wednesday, July 8, closing with a paper by Secretary J. N. Hurty, of the board, giving a history of the movement for pure water in Indiana, and papers on the public water supply by Geo. W. Fuller, consulting engineer, New York, and the ground water supply by Marshall O. Leighton, of the U. S. Geological Survey.

The afternoon session of Wednesday will have papers by Prof. R. L. Sackett, of Purdue University, on "The Pollution of White River;" by Howard A. Dill, superintendent of the Richmond Water Co., on "The Gallery Well Supply;" by Christ Walling, superintendent of the Muncie Water Co., on "Experiences with Salt and Oil;" by J. H. Brewster, water chemist of the board, on "Methods of Analysis," and by H. E. Jordan, chemist of the Indianapolis Water Co., on "The Causation of Typhoid Fever."

Those attending the conference are to be tendered a dinner Wednesday evening.

The morning session of Thursday has papers by A. H. Kennedy, president of the Rockport Water Co., on "Water Supplies in Small Cities in South Indiana;" on "Water Rates and Rentals," by Charles Carroll Brown, consulting engineer, Indianapolis; on "Wells and the Public Supply in Indianapolis," by Dr. Eugene Buehler, secretary of the Indianapolis Board of Health; on "Stream Pollution," by F. A. W. Davis, president of the Indianapolis Water Co.; on "Bad Tastes and Odors," by Superintendent Weisenberger, of the Vincennes Water Co.; on "Ohio River Water," by Superintendent Peck, of the Evansville Water Works; on "Present Condition of the Water Supply," by H. E. Barnard, chemist of the board; on "Water Purification," by Mr. Taylor, waterworks engineer, Terre Haute; and on "A System of Waterworks Bookkeeping," by Dow R. Gwin, superintendent of the Terre Haute Water Co.

A visit will be made to the filter plant of the Indianapolis Water Company on Thursday afternoon.

Those interested in any way in water supplies for cities and towns are invited to the conference, especially residents of the state of Indiana.

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### Technical Meetings.

The American Society of Municipal Improvements has postponed its next convention from October 13-16 to October 20-23, so as to not interfere with the meeting of another society which had first been fixed on the earlier date at the same meeting place, Atlantic City. A. Prescott Folwell, sec'y., 512 Flatiron Bldg., N. Y. City.

The International Association for the Prevention of Smoke met in Cleveland, O., June 24-26. Among the papers presented were Prof. C. F. Maberry's on the "Chemistry of Combustion," Prof. N. W. Lord's on "Fuels of the United States," Prof. R. H. Fernald's on "Gas Engines and Gas Producers," Prof. C. H. Benjamin's on "Fuel and Boiler Room Economics," from the technical side; W. E. Mook's on the "Legal Side of the Smoke Question; H. W. Woodward's on "Mechanical Stokers," A. W. Puddington's on "Steam Jets," P. W. Cobb's on "Central Stations for Power and Heating," from the mechanical side; and Paul C. Bird's on "City Supervision of New Boiler Plants," W. E. Taylor's on "Air Cleansing Apparatus as Applied to Round Houses and Blast Furnaces," D. C. Walmsley's on "Stationary Plants," D. T. Randall's on "What the Government is Doing," and John Krause's on "Railroad Smoke, from the administrative side.

At the annual meeting of the New York Electrical Society, held June 17 at the Hotel Astor, the following officers were elected: Henry A. Lardner, president; W. Noble Dickinson, Jr., J. C. Forsythe, S. D. Sprong, vice presidents; George H. Guy, secretary, and H. A. Sinclair, treasurer. F. A. Muschenheim read a paper on "Electricity in the Modern Hotel," which was followed by an inspection of the electrical equipment of the hotel and the many ingenious electrical novelties introduced by Mr. Muschenheim.

Michigan Agricultural College, at Lan-

sing, Mich., dedicated a new engineering building on June 22.

The officers of the Iowa Cement Users' Association are Geo. H. Carlon, Oskaloosa, president; John W. Budd, Des Moines, and W. J. McCracken, Paulina, vice presidents; Ira A. Williams, Ames, secretary, and Geo. R. Ross, Grinnell, treasurer.

### Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

July 1, 2, hydrographic draftsman, Coast and Geodetic Survey, at $900 a year.

July 8, engineer, schedule B, in U. S. Mint at Denver, Colo., at $4.25 a day.

July 8, 9, fortification draftsman, engineer department at large, San Francisco, at $1,500 a year to begin.

July 22, 23, 24, electrical engineer and mechanical draftsman in the Reclamation Service, at $100 to $200 a month and upward.

### Tests of Reinforced Concrete Columns.

The University of Illinois Engineering Experiment Station has recently issued bulletin No. 20, Tests of Concrete and Reinforced Concrete Columns, Series of 1907, by Professor Arthur N. Talbot. This bulletin records experiments upon concrete and reinforced concrete columns, which have already become quite notable and which will have a marked influence in fixing the standing of certain types of construction. One of the leading engineering journals in commenting on the importance of the results of these tests states that they bear on nearly every phase of importance of reinforced concrete columns. The tests go to show that in hooped columns the steel hooping does not come into action to any great extent before a load equivalent to the ultimate strength of plain concrete, or a little below, is reached, and that up to this point the action of the column is very like one of plain concrete. Beyond this load the column shortens rapidly and the deformation becomes very marked. The extreme amount of shortening is a great disadvantage. The amount of strength added by the hooping before ultimate failure is reached, is two to three times as much as the effect of an equal amount of longitudinal reinforcement. A discussion of the French and German experiments is made, and observations on Poisson's ratio and data on the phenomena accompanying tests of plain concrete columns are given. The work of Professor Talbot in reinforced concrete is well known, and this investigation is a further evidence of the importance of the work of the Engineering Experiment Station. The bulletin contains 60 pages.

Copies of this bulletin may be obtained gratis upon application to the director, Engineering Experiment Station, Urbana, Ill.

### Personal Notes.

Mayor Paff has been re-elected at Alexandria, Va.

Hon. W. L. Rice has been re-elected mayor at Bristol, Va.

John Turner has been appointed village engineer at Oakwood, O.

Hon. Robert W. Speer has been re-elected mayor of Denver, Colo.

H. A. Holstein has been re-elected city engineer at Titusville, Pa.

Hon. G. W. Smith has been re-elected mayor at Lynchburg, Va.

Col. Maryus Jones has been elected mayor at Newport News, Va.

Hon. J. E. Supplee has been re-elected mayor at Potomac, Va.

E. A. Wilson, assistant city engineer at Duluth, Minn., died recently.

Sam Huston, former State Highway Commissioner of Ohio, died recently.

W. L. Glazier has been re-elected superintendent of water-works at Newport, Ky.

John F. Gallagher has been re-elected superintendent of water-works at Kingston, N. Y.

Charles Slater has been elected mayor at Mansfield, Ill., to succeed Mayor Gladden, resigned.

Hon. J. M. Hines has been re-elected mayor at Bristol, Tenn., and W. M. Hamilton city clerk.

Garwood Ferguson has been appointed engineer of Passaic County, N. J., to succeed Colin R. Wise.

J. S. McCullough has been elected city engineer at Fond du Lac, Wis., succeeding L. A. Pettibone, resigned.

Dr. James G. Riddick has been re-elected mayor and Col. Harry Hodges a member of the board of control at Norfolk, Va.

Frank R. Lanagan, Jun. Am. Soc. C. E., formerly assistant city engineer of Albany, N. Y., has been appointed city engineer of Auburn, N. Y.

Nathaniel Henry Crafts, city engineer of Boston, Mass., from 1864 to 1872, died June 14 after a protracted illness at his home in Stoughton, Mass.

Guy C. Emerson, M. Am. Soc. C. E., has been appointed superintendent of streets at Boston, Mass., and will have charge of all street work except that under the water department.

Alexander Potter, consulting engineer, New York City, sailed for Europe June 20, to study English and German practice in water softening and methods of sludge disposal in sewage purification plants.

William S. Akerman and Julius A. Lebkuescher, members of the Passaic Valley Sewerage Commission of New Jersey, sailed for Europe recently to study sewerage systems in England and Germany.

Alexander Leggat has resigned as city engineer at Butte, Mont., and has resumed practice as a mining engineer and agent for non-resident owners of mining property in Montana and Idaho, with offices in the Hirbour building, Butte.

W. A. Aiken, for eight years general inspector of materials of construction for the New York subway, has joined the Henry S. Spackman Engineering Co., of Philadelphia, Pa., as vice president, and will give his personal attention to all inspection. He will have the assistance of his former corps of experts as weill as of that already attached to the H. S. Spackman company.

Arthur Codezo Vinageras, C. E., 117 Prado street, Havana, Cuba, has resigned as assistant engineer of the Public Works Department after years of valuable service and established the Bureau of Hygienic and Economic Building at 117 Prado st., Havana, Cuba, for the designing and

construction of special buildings for the tropics, in which the best structural systems of steel and reinforced concrete work and of health protecting and refrigerating engineering are to be used.

Hazlehurst & Anderson is the designation of a new firm of consulting municipal engineers, with general offices in the Candler building, Atlanta, Ga. It is composed of James Nisbet Hazlehurst, who is a member of the American Society of Civil Engineers, the American Society of Municipal Improvements and the American Water Works Association, and Chas. L. B. Anderson, an associate member of the American Society of Civil Engineers.

# MACHINERY AND TRADE

### Report of Lumber Production of the Lake States.

The lake states, one of the greatest forest regions that ever contributed to the lumbering activities of any country, are rapidly falling behind in timber production, according to a preliminary statement issued by the Bureau of the Census.

Statistics concerning the annual output of forest products, collected by the Bureau of the Census in co-operation with the United States Forest Service, from more than 2,100 saw-mill operators in Michigan, Wisconsin and Minnesota—the big three—have shown that the cut last year was only five and a half billion feet of lumber, a big pile, yet 12 per cent. less than the cut of the preceding year.

The heavy inroads made in the exploitation of the timber resources of the large lumber states on the Great Lakes have been too much for the great forests and the amount available for cutting is getting lower each year. The decadence of the lumbering industry in this region is forcefully illustrated in the drop in the white pine cut during the past ten years. Michigan's forests of this valuable tree were the richest in the world and were often said to be inexhaustible. The folly of such a statement is shown by the report that the cut of white pine in Michigan last year was only one-fourth of what it was in 1899, only eight years before.

In lumbering the forests no thought was given to anything but immediate money returns, and consequently the countless fires running over the land, after the timber was cut, have killed young growth over wide areas and greatly impoverished the soil. Now 6,000,000 acres, or nearly one sixth of the state of Michigan, known as the "pine barrens," have been thrown on the delinquent tax list and are a burden to the people. Under proper forest management this land would have been producing timber today. Between 1899 and last year the white pine production fell off nearly as much in Wisconsin as in Michigan. In Minnesota, the state which now contains the largest amount of virgin white pine, the decrease in the same period was nearly one-third.

Taking the three states together, pine constituted nearly forty-six per cent. of the total lumber production in 1907, hemlock a little more than twenty-seven per cent. and maple ten per cent., the balance being made up mostly of basswood, birch, tamarack, elm, beech, oak, spruce, ash, and cedar, in the order given. The pine is mostly white and Norway, which are grouped together under the general trade term of "northern pine." Pine made up over nine-tenths of the lumber produced in Minnesota, one-third of that produced in Wisconsin, and less than two-fifths of the total cut in Michigan.

Along with this great decrease in pine, there have been relatively as heavy decreases in the most valuable of the hardwoods, oak, elm and ash. Little more than one-fifth as much oak was cut in the Lake States last year, for instance, as in 1899, while the cut of elm and ash was but half that of eight years earlier. As is always the case, the decreasing supplies of the more valuable woods have caused those once considered of little or no value to be drawn upon heavily. This has been particularly true with hemlock, so that now more hemlock than pine lumber is manufactured in Wisconsin, and twice as much hemlock as pine cut in Michigan. There have been heavy increases in the use of maple, birch and beech within the last few years, but the maximum cut of these species is probably near at hand; and taking all of the hardwoods together, there has been a slight falling off since 1899.

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### Cement for Panama Canal.

After repeated postponements the Isthmian Canal Commission, Washington, D. C., opened proposals June 1 for furnishing 4,500,000 barrels of Portland cement for construction work on the Isthmus, the deliveries to begin about December 1 at

United States ports, or at Isthmian ports in ships of American or foreign register. Twenty-five proposals in all were made, including the big American corporations and a number of European cement manufacturing concerns. All bidders who proposed to deliver the entire amount at Isthmian ports offered to do so in foreign bottoms. Four American firms submitted proposals to supply the entire amount, and a fifth, the Commonwealth Cement Company of Virginia, offered its property to the government on condition that it be paid a royalty of 25 cents a barrel, the plant to revert to the company when the supply necessary had been delivered. On this basis it was claimed the cement would cost the government more than 88 cents a barrel at the mill, or $1.28 delivered at Colon.

Bids of firms offering to supply the entire amount included the following:

Lehigh Portland Cement Company and the Alpha Portland Cement Company of Allentown, Pa., joint bid, delivered at Colon, $8,212,500; delivered United States ports, $6,412,500.

F. J. Duggan, 1133 Broadway, New York, delivered at Colon, $7,830,000.

Santa Cruz Portland Cement Company of San Francisco, delivered on dock at Portland, Ore., $6,243,750.

Atlas Portland Cement Company, New York City, delivered on dock United States, $5,355,000.

All the foreign bids were for quantities less than the full amount required.

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### Testing Cement at the Mill.

The Henry S. Spackman Engineering Co., 42 N. 16th street, Philadelphia, Pa., have greatly strengthened their inspection department by the acquisition of W. A. Aiken as vice president and his corps of expert inspectors as employes. Offices have been opened in Easton, Pa., in the Lehigh region, and they are now in position to sample cement at the mills, thus insuring only the shipment of cement passing specifications, which does away with the necessity of providing large storage on the work. The cars are loaded in the presence of their inspector, who samples the cement as it is being loaded and seals the car with their private seals in addition to the railroad seals. Where considerable quantities of cement are being used bins of cement are sampled in the process of manufacture, the bins are sealed and no cement is loaded for the work except in the presence of their inspector and the cars are then sealed with their seals.

The inspections cover tests for setting time; fineness on the No. 100 and No. 200 mesh sieve; constancy of volume; steam or boiling test; cold water and air; tensile tests, 7 and 28 days neat, and 7 and 28 days one cement and three sand; also determination of sulphuric anhydride and magnesia if desired.

### An Automatic Street Scraper.

A new street scraper for cleaning streets by hand, which is mounted on wheels and dumps automatically, has been put on the market by W. M. Toy & Co., 108 East avenue, Sidney, O. The accompanying photographs show the principles on which the machine operates better than any description.

The scoop is made of one piece of the best material, and has a detachable steel blade which takes the greater part of the

TOY AUTOMATIC STREET SWEEPER AT WORK.

wear. It is 4 feet long, unless ordered of another size, and has a 9-inch blade. The yoke, hounds and bail are of steel, insuring against breakage, and the wheels and stops are of high-grade cast iron, strong enough to carry the heaviest loads. The handle and cross-piece are of hickory, thoroughly mortised and bolted.

The first cut shows the scraper in position to clean the street. It can be raised

TOY AUTOMATIC STREET SWEEPER DUMPING POSITION.

so as to hold the accumulated dirt and carry it on the wheels by pressing with the right hand the lever shown on the handle, which will raise the bail, and move the handle upward until the bail passes the top stop. Thus tilted, it can rest on the ground or be lifted off it by pressing down on the handle and trundled off on the wheels. To dump the scraper, press the lever, which will throw the bail off of the top stop and the bail will drop below the lower stop. Raise the handle slightly

and the scoop will turn completely over, and can then be hauled out and away, as may be desired. Being lifted off the ground when hauling refuse, the scraper creates no dust and the loose wheels give liberty to turn freely in any direction.

The writer has seen the scraper in operation and finds it a material improvement over the ordinary scraper. Mr. Toy will send the machine to any municipality or street cleaning contractor on thirty days' trial. Circulars descriptive of the machine will be sent on application to the above address.

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### Construction Costs Reduced This Season.

Some figures, taken from a recent issue of the *American Lumberman*, give indications of the reductions in cost of building in 1908 from that in 1907 and some of the reasons therefor. One of the principal reasons is the greater efficiency of labor under the spur of the increased difficulty in finding a new job if the one on hand is lost, but there has been some reduction in prices of materials also as is shown in the following:

When the call for carpenters is greater than the supply men unskilled in the work can secure employment at high wages and skilled workers can command special prices. When the supply of labor is greater than the demand workmen can be secured on better terms and will give greater and better service. Labor is cheaper now than it was a year ago, although nominally wages are the same. It is cheaper because it is better.

Materials are cheaper than they were a year ago, not for the same reason that labor is cheaper, but in the actual prices that must be paid. Last year the majority of the dealers in building material had all the trade they could handle. This year business has been fair, as shown by the building records, but there is room for a very considerable improvement. As a general proposition lumber now is being sold for 10 to 15 per cent. less than during last year. Ten per cent. probably represents about the general decline in the retail price of building material.

A Cleveland operator has supplied some specific information showing the relative cost of building in 1907 and 1908 which is reproduced herewith:

| | 1907. | 1908. | Percent of decrease. |
|---|---|---|---|
| Masonry and grading. | $1,329 | $944 | 29.0 |
| Plastering | 585 | 313 | 46.8 |
| Plumbing | 640 | 500 | 21.9 |
| Heating | 730 | 570 | 22.0 |
| Painting | 530 | 400 | 24.5 |

Lumber, $4 to $6 a thousand less.

The foregoing comparative values represent actual figures secured by a gentleman who wished to build. The 1907 prices were made during the latter part of that year and the 1908 prices in June.

The total cost in 1907 would have been $3,814 for the items mentioned. For 1908 the bids put in represented a cost of only $2,727, a saving of $1,087 on the building for which prices were secured, representing a decrease of 28.5 per cent. This reduction possibly may be out of the ordinary. It scarcely is possible that building could be done for a third less now than in 1907, but the figures given represent estimates made by contractors during the two periods.

What is said of one town may not be applicable to another and probably would not be applicable to all the country, but in every city and every village in the United States it is a comparatively easy matter to determine the relative cost this year and last, and beyond question it will be found that buildings can be put up this year at a saving of anywhere from 10 to 25 per cent. of the cost in 1907.

This is the time to build.

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### Another Decision in Favor of Bitulithic.

On June 13 Judge Hanna, of the Superior Court of Marion county, Indiana, decided the case of Pierre Gray vs. The City of Indianapolis and the Hoosier Construction Company in favor of the defendants.

This was a suit brought to restrain the city and the Hoosier Construction Company from proceeding with the improvement of Thirtieth st. by paving the same with the bitulithic pavement, claiming that the pavement was patented, and even though the Warren Bros. Company, the owners of the patents, had filed an agreement with the city of Indianapolis, offering to let every bidder use the patents for laying and maintaining the pavement, for the sum of 25 cents per square yard, that there was no competition, and therefore the court should enjoin them from going on with the work.

Another ground on which the plaintiff asked an injunction was that, by the adoption of general specifications, say for bituminous macadam and bitulithic, any other mixture of broken stone and bituminous cement could be bid upon by various bidders and thus competition would be provided.

In deciding the case Judge Hanna held that when the city and the patentee permitted all prospective bidders to use the patents at a fixed and reasonable price, there was as much opportunity for competition on a patented pavement as there was on other kinds of work, for the reason that in bidding on any public work there is always some article entering into the work that has a fixed price to all bidders.

In regard to the second point, the Judge held that the statute requires the Board of Public Works to adopt "full details, drawings and specifications" for the particular work to be done, and this necessitates such a careful description of the materi-

als, and methods of doing the work, that any general specification which would permit bidders to bid on two or three different kinds of pavements would be void for uncertainty, and that a specification that would properly describe a patented pavement could not be legally drawn, so as to also cover an unpatented pavement, without infringement.

Several other suits are pending by which the city is temporarily restrained from proceeding with bitulithic work, and this decision is an indication of the probability that they will be decided the same way, and the restraining orders dissolved and the city permitted to go on with the various improvements of this kind that were under way for the year.

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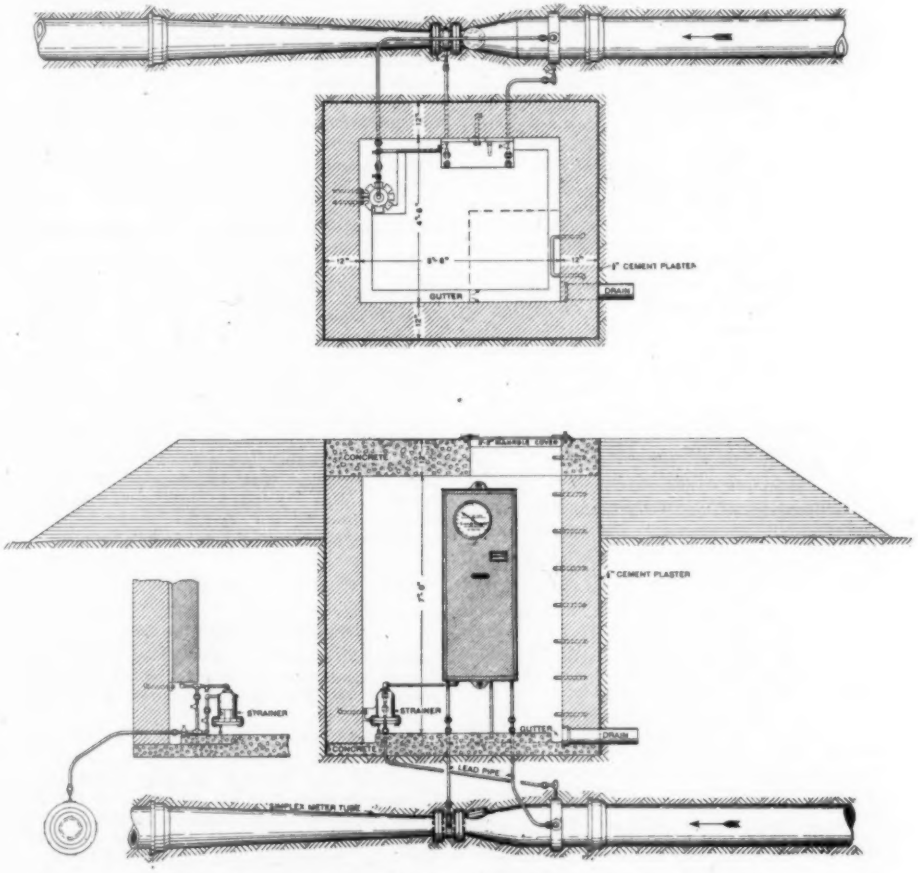
### Simplex Meter Setting.

The accompanying drawing shows the method of setting the register of the simplex meter in the ground. It is practically self-explanatory, the upper drawing showing the plan of the setting and the lower drawing the vertical longitudinal section. The simplex meter is a Venturi meter with the register attachment, and is an indispensable adjunct of any water works system which wishes to keep track of what becomes of the water furnished. Full information will be supplied by the Simplex Valve and Meter Co., 112 North Broad st., Philadelphia, Pa.




PLANS FOR SETTING REGISTER AND SIMPLEX WATER METER.

### Imports and Exports of Cement.

In April the importation of cement amounted to about 36,000 barrels, a little more than ten per cent. of the importation in April, 1907. For the ten months ending with April, the importation was about 1,370,000 barrels, a little over half that during the corresponding period of the previous year.

Exports in April were 66,836 barrels, an increase of twenty per cent., and in the ten months ending with April, 777,415 barrels, an increase of forty per cent.

**Robert W. Hunt & Company, Engineers.**

The firm of Robert W. Hunt & Co., engineers, bureau of inspection, tests and consultation, is a large one. They maintain offices in Chicago, New York, Pittsburg, San Francisco, Montreal, St. Louis, London and Buenos Ayres, with staffs of inspectors located at various manufacturing plants throughout the United States and Canada, as well as in Europe. During the twenty-one years which they have been in business they have enjoyed an enviable reputation, which can be ascribed to the competency and integrity of their employes under an ideal management. While the employes of the company can be classed in two departments, an engineering and inspecting department, yet there is no definite line between the two. They cooperate. In general, the inspection work is under the direction of the technical men, engineers. Furthermore, these engineers are constantly being detailed on inspection work, while, on the other hand, the inspectors, as specialists in their lines, render the engineers valuable assistance.

The company's staff of mechanical, civil and electrical engineers have shown ability in a consulting capacity as the designers of power plants, electric railways, lighting and heating plants, cement and gas plants and in the investigation and appraisement of mining properties, etc. The advantage of having the advice of a large staff of experienced engineers in consultation is unquestionable.

Their corps of inspectors consists of a large force of practical and experienced men, experts each in his line. The company makes a speciality of the inspection of general railroad material, such as rails, bridges, locomotives, cars, as well as all accessories, such as splice bars, bolts, spikes, car wheels, axles, etc. In this connection some conception of the extent of their business might be drawn from the fact that they inspect very nearly 75 per cent. of the rails manufactured in the United States. Besides general railroad material they inspect almost every class of material, including cement, pipe, boilers, etc.

In the matter of inspection work Robert W. Hunt & Company are in a position to inspect the material of small purchasers. With men stationed constantly at the various manufacturing plants they can give the small orders of purchasers as sufficient and efficient inspection as the large orders, and at an expense only proportional to the size of the order. The cost of inspection from any individual source, not maintaining men permanently at manufacturing plants, would, on small orders, of necessity be entirely disproportionate to the cost of manufacture.

The value of intelligent inspection should not be underestimated. The manufacturer may guarantee the life of an axle, for example, yet a defective axle, causing an accident, with its accompanying suits for damages, renders him (the manufacturer) only liable to the replacement of the axle. The purchaser, however, must bear the bulk of the expense. It might be very conservatively stated that the expense of one such accident would be ample to secure the services of inspection on all material bought by the purchaser through many years. Nor is the actual cost of the accident and damages any measure of the complete loss. The loss of the public confidence is a loss to the railway company not to be overlooked. The retention of reliable inspectors furnishes to the public an assurance that every effort is being made to protect their lives and property.

Robert W. Hunt & Company can point to the tremendous growth of their business even in the last sixteen years as an indication of a definite recognition of the value of competent inspection.

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**Increase in Southern Construction.**

Mr. G. W. Benton, who is the secretary of the Conneaut Shovel Company of Conneaut, O., has recently returned from a trip through the South. The large trade which has developed in that region shows the increase in construction in the "new South." Mr. Benton established agencies with J. E. Lastrapes, 524 Gravier street, New Orleans, La., and the Atlanta Mill Supply Co., Atlanta, Ga., to take care of this trade, and large stocks of his company's shovels will be carried at both places. This company makes shovels of special designs for special purposes and is particularly successful with the Ronberg contractor's shovel and the Mikola ore shovel.

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**Trade Publications.**

The Victor dump wagon is shown in detail in a handsomely illustrated catalog issued by F. H. Hieber Wagon Mfg. Co., Pittsburg, Pa.

Sarco mineral rubber pipe coating, the method of application and the action and value of this method of protecting pipe from corrosion are all fully set forth in a well written booklet issued by the Standard Asphalt and Rubber Company, First National Bank building, Chicago, Ill.

The most prominent feature of the June Bulletin of the Universal Portland Cement Co., Chicago, Ill., is a photograph of plants 3 and 4 of the company at Buffington, Ind., taken from a camera suspended from a series of aeroplanes at a height of 1,000 feet above the ground.

The 1908 edition of Bottomley's "Directory of Portland Cement Manufacturers of the United States" has been issued. It is an improvement over former editions in that it separates the lists into three divisions, those in operation, those under construction and those in contemplation. The officers, capacity and names of Portland cement brands are given. The lists are

fairly complete and can be obtained from C. Earle E. Bottomley, Rothschild building, Philadelphia, Pa.

The Carnegie Trust Co., Trinity buildings, New York City, send an illustrated description of their Carnegie safety deposit vaults, said to be the largest and strongest in the world.

A 1908 booklet entitled "Corrugated Bars for Reinforced Concrete Construction," issued by the Expanded Metal and Corrugated Bar Co., of St. Louis, Mo., is largely devoted to illustrations of the many kinds of structures in which the bar has been used. It also contains formulae and tables for use in designing. A new corrugated round bar is announced as now ready for delivery.

Charles Cottingham, C. E., Danville, Ill., has issued in a booklet his report on a sewerage system for Hoopeston, Ill. It will be found an interesting and instructive paper on the points to be considered in the design of a system of sewers for a small city.

Petrolithic pavements and roads are described in a pamphlet illustrated with photographs issued by the Petrolithic Pavement Co., Los Angeles, Cal.

Butt-welding wrought iron and steel pipes and rods by the thermit process is described in a revised circular issued by the Goldschmidt Thermit Co., New York.

The Downard-Lester Rock Asphalt Co., Ardmore, Okla., publishes a pamphlet on the municipal ownership of paving plants.

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## Trade Notes.

### ASPHALT.

Atlantic City, N. J.—The United Paving Co. has been incorporated to conduct a general paving business, by A. M. Jordan, Van Buren Giffin, Louis Kuehnle, Robert Delany, Harry Bacharach, David Holland, Rufus Booye, W. E. Shackelford and W. I. Cherry.

### BRICK.

Bay City, Mich.—The plant of the Michigan Vitrified Brick Co., situated just outside of this city, has been purchased by the New Era Vitrified Brick Co., of Detroit, and will be placed in operation at once.

Minneapolis, Minn.—The Minnesota Paving Brick Co. has been incorporated by Samuel J. Hewson, Peter J. Meyer and Charles J. Rockwood.

Cleveland, O.—Special. The Deckman-Duty Brick Co., of this city, announces the consolidation of the Malvern Clay Co., of Malvern, O., with the Collingwood-Deckman-Duty Clay Co., with plants at Malvern and Carrollton, O. The officers of the new company are: President, Spencer M. Duty; vice president, secretary and manager of sales, Charles J. Deckman; treasurer, Herbert C. Moatz. The name of the company is the Deckman-Duty Brick Co., with offices at 854-856-858 Rose building, Cleveland. The management and its plants will be under the personal direction of Charles J. Deckman and Spencer M. Duty, who have individually, heretofore, managed the Malvern Clay Co. and the Collinwood-Deckman-Duty Co.

### CEMENT.

Trenton, N. J.—The Coloseum Cement Co. has been incorporated to manufacture cement, by William H. Williams, F. Winthrop White and Robert V. Kelly, all of Jersey City.

Red Deer, Alta.—The Edmonton Cement Co. is negotiating with the town council here to establish a cement plant.

Index, Wash.—A large deposit of limestone is being opened up near Grotto, 14 mis. from here, which is said to be suited to the manufacture of Portland cement.

Gardiner, Mont.—A large cement plant will be constructed here, involving an expenditure of about $1,500,000.

Chattanooga, Tenn.—The Mobile Portland Cement Co. has been incorporated and will erect the largest cement and coal plant in the world. The company's capital stock is $6,000,000 common and $3,000,000 preferred. Among the directors of the company are C. H. Treatt, U. S. treasurer; E. L. Russell, vice president of the Mobile & Ohio R. R.; Patrick J. Lyon, mayor of Mobile, Ala.; W. W. Finley, president of the Southern R. R., and others. The plant will be located at St. Stephens, Ala.

### CONCRETE BLOCKS.

Nashville, Tenn.—The Concrete Construction Co. has been organized and will engage in concrete block and sidewalk construction, but its specialty will be reinforced monolithic work. The company will take over the unfilled contracts of the Granitoid Construction Company.

Mayville, N. D.—The Electrical Cement Post Co. will install a cement block plant.

Sheffield, Ia.—The Sheffield Cement Tile & Block Co. has been incorporated and a cement tile and brick plant will be built this summer. L. S. Sullivan will be active manager.

Bar Harbor, Me.—The Morrison Concrete Construction Co. has been organized and will conduct a general industrial and commercial business. The officers of the company are president, A. G. Morrison; treasurer, M. C. Morrison.

Eureka, S. D.—The Linton Cement Works has been organized by E. D. Fogel and Frank J. Haas, and cement blocks, tile and everything pertaining to the cement industry will be manufactured.

Anoka, Minn.—The cement block works owned by Dr. J. F. Kline have been leased by W. J. Green, who has begun the manufacture of cement blocks.

Marmarth, N. D.—The Meinecke Building Co. has engaged in the manufacture of cement blocks.

East Grand Forks, Minn.—W. D. Rowe has decided to remove his cement plant from Crookston to this city.

Montrose, Minn.—The Farmers' Co-operative Co. will establish a cement block plant here.

Barnesville, Minn.—J. H. Fisch will shortly begin the manufacture of cement blocks.

Spring Valley, Wis.—Udel Van will manufacture cement tiling.

Yale, S. D.—A new cement block plant will be established here by F. S. Davis.

Lincoln, Ill.—Charles E. Sims contemplates organizing a stock company to establish a concrete tile and block plant at Worthington, Minn.

Hurdsfield, N. D.—S. Hanson will establish a cement block plant.

Austin, Minn.—A. E. Beall has patented a cement burial vault made in 12 sections.

Hurley, S. D.—The Hurley Cement Tile Co. has commenced operations.

### NEWLY INCORPORATED COMPANIES.

Washington, D. C.—National Concrete Steel Co.: Eldridge R. Boyle, William B. Upton, Conrad H. Syme.

Madison, Wis.—Madison Concrete Mfg. Co.: J. W. Pengelly, Maurice Carroll, Harold Togstad.

Oberlin, O.—The Oberlin Concrete and Coal Co.: M. A. Houghton, D. E. Butler, C. E. Houghton, J. M. Woods, M. A. Whitney.

Milwaukee, Wis.—The Wisconsin Concrete Building Supply Co.: John A. Lohmann, Charles G. Moritz, Fred W. Runkel.

Cincinnati, O.—The M. Dugan Concrete Co.: James N. Dugan, E. J. Tully, E. J. Oliver, M. L. Maddix, H. W. Bonte.

Denver, Col.—The Cement and Concrete Construction Co.: Alexander J. Graham, Warren D. Simons, George W. Polk.

Philadelphia, Pa.—The Peerless Cement Brick Co.: Horace M. Duyckinck, treas.

Louisville, Ky.—The American Concrete Construction Co.: F. W. Graham, F. E. Short, J. H. Poohe.

Schenectady, N. Y.—The Young & Schester Cement Stone Co.: Jacob Young, George Schester, Barbara Young.

Wilmington, Del.—The Brandywine Cement Brick and Block Co.: John Frank Curry, Edward Krause, Matthew F. Hayden.

Morgan Park, Ill.—Morgan Park Concrete Co.: Earl Crossman, Otto Sagan, Earl C. Hales.

Reading, Pa.—The Glengary Brick & Cement Co.: A. A. Gery, F. S. Gery, Wm. A. Gery. The plant will be located at Shoemakersville.

Jackson, Mich.—The Advance Concrete Mixer Co.: David J. O'Connell, Alvin E. Knowles, Roger Sullivan, Harry F. Abbott, Sid L. Wiltse, John L. Lautensiager.

Baltimore, Md.—The Garrison Concrete Stone Co.: Mortimer W. West, G. Harry Haynes, Thomas J. Flannery, Martin H. Murray, John P. Paca.

Terre Haute, Ind.—The Strong Concrete Products Co.: J. G. Elder, Sutton Strong, C. E. McKeen, Elsworth Lawrence, W. H. Berry, S. E. Gray, J. M. Vickroy, F. R. Higgins, A. S. Miller.

Rumford Falls, Me.—The Oxford Pressed Stone and Concrete Co.: President, Albert E. Small, of Mexico; treasurer, Louis H. Veilleux, of Rumford Falls.

Hoboken, N. J.—The Concrete Brick Co.: G. Spencer Ridner, Hoboken; Wm. H. Coe, 42 Broadway, N. Y. City; Charles H. Phillips, Cassadaga, N. Y.

New York City.—The New York Silica Brick Co.: Wm. B. Parsons, 60 Wall st., N. Y. City; Joseph Bailey, Patchogue, N. Y.; S. L. F. Deyo, 13 Park Row; St. John Clarke, 411 E. 42nd st.; Frank A. Crandoll, 39 Cortlandst st.

### LIGHT, HEAT AND POWER.

Green Bay, Wis.—The Hydro-Electric Power Co. has been organized here to furnish electric power to the Green Bay Traction Co. to operate the electric railway, and for the Green Bay Gas and Electric Railway and other plants.

### MISCELLANEOUS.

Port Huron, Mich.—The Country Roads Construction Co. has been organized and incorporated to bid on the construction of macadam, gravel or roads to be laid with any other material. The officers of the company are: President, D. C. Kinch; secretary, F. R. Whipple; treasurer, F. T. Moore.

Ocean Grove, N. J.—The Sanitary Utilization Co. has been incorporated by H. K. Brick, Raymond Wells and John F. Mesier.

Millburn, N. Y.—The Millburn Trap Rock Co. has been incorporated by Herbert Lighthipe, Herbert V. W. Lighthipe and Charles C. Spencer.

East Liverpool, O.—Special.—The Ohio Valley Finance Co. will receive bids July 6 for constructing a car barn. Plans and specifications may be seen at the office of A. G. White, C. E., Toronto, O.

Prices on cast iron pipe for the past two months have remained about $24.50 to $25 per net ton for 6-inch pipe in New York, $26 in Chicago and $23 in Birmingham.

The Merchants' Association of New York announces round trip rates of 1½ fares under certificate plan to New York in the Trunk Line Association's territory, Eastern States as far south as the C. & O. R. R., on August 15 to 19 and August 29 to September 2, with 15-day return limit.

The Adams Company, motor car makers, Dubuque, Ia., send full descriptions and photograph of their new gyroscopic revolving airship motors, which weigh only 2.7 pounds per horse power, in running order.

The Bristol & Warren Water Works, Warren, R. I., have closed contract with the Aberthaw Construction Co. for the building of a tidewater dam and the foundation for a fresh water reservoir. The dam is intended to prevent the flow of sea water into the reservoir at very high tides. The filter tank and foundations for the pumping station at this plant were built last year.

On May 29 the board of public works of Rome, N. Y., gave the Warren Brothers Company contracts for paving six streets with bitulithic, amounting in all to $53,-040.42. It may be remembered that a fierce attack was made on the North James street pavement, in Rome, about six years ago, but the opinion that this street is the best in the city to-day was the reason given by some of the petitioners for preferring bitulithic. One June 18 the trustees of Herkimer, N. Y., let contracts for seven streets to the Warren Brothers Company for bitulithic, at $2.28 on a 4-inch and $2.48 on a 6-inch foundation. The total amount of the contracts is about $90,000. Proposals were received also for asphalt, brick and concrete.

The city of Great Falls, Mont., is growing rapidly, more than a million dollars of expenditure for buildings and improvements to be expended this year. As no one improvement will cost more than $60,-000, the general nature of the advance is clearly shown. Among the structures is a chimney for the Amalgamated Copper Co., said to be the largest in the world. It will be 506 feet above the foundation, 54 feet in diameter at top and 74 feet at the bottom.

### SEWER PIPE.

Manhattan, N. Y.—The American Concrete Co. has been incorporated to manufacture drain and sewer pipe, etc., by R. D. Druhan, of New York City; G. D. Hulett, of Newark, N. J.; F. B. Vermilya, of New York City.

# IMPROVEMENT AND CONTRACTING NEWS

## PAVING.

Des Moines, Ia.—Councilman McVicar is in favor of constructing macadam roads in the outlying districts of this city, where paving is not practicable.

### CONTEMPLATED WORK.

Hayward, Cal.—Asphalt paving is contemplated for Castro st.

Westfield, Mass.—Macadam paving is proposed for Pleasant st.

Toronto, Ont.—The city council has decided to pave Harbor st.

Poughkeepsie, N. Y.—Vitrified block paving is contemplated for Main st.

Chatfield, Minn.—Council has authorized the construction of cement sidewalks.

Sandstone, Minn.—The construction of sidewalks in Commercial st. is contemplated.

Memphis, Tenn.—The resurfacing of Union ave. with crushed stone is contemplated.

Mt. Vernon, Wash.—The city clerk has been directed to ask for bids for improving C st.

Rochester, Minn.—Macadam paving is contemplated in Franklin st., from Fifth to Zumbro.

Burlington, Ia.—The resolution to pave 9th st. has been signed by Mayor Underkircher.

Puyallup, Wash.—Paving is contemplated for Meridian and other streets in the business district.

St. Paul, Minn.—The resurfacing of W. 6th st., from Washington st. to Smith ave., is contemplated.

Aberdeen, Wash.—Resolutions have been adopted authorizing street improvements to cost $93,000.

Grand Rapids, Mich.—The estimated cost of grading and paving S. Ionia st., with brick is $25,140.

Perth Amboy, N. J.—The residents on Kearney ave. have petitioned for bituminous macadam paving, from Market to Lewis sts.

Detroit, Mich.—The residents of Springwells twp. voted to issue $25,000 bonds for paving Michigan ave.

Clara City, Minn.—The construction and repair of cement sidewalks have been authorized by council.

Ellsworth, Minn.—The construction of new cement sidewalks throughout the village is contemplated.

Findlay, O.—The contract will be let about July 1 for brick paving. U. K. Stringfellow, cy. engr.

Maryville, Mo.—Bids will be received soon for constructing ½-mi. of brick paving. M. A. Peery, cy. clk.

Oshkosh, Wis.—Brick paving for Osceola st. and macadam paving for Vine st. is contemplated.

Hoosick Falls, N. Y.—Voted to appropriate $50,000 for paving and curbing the main streets of this village.

Sharon, Pa.—An ordinance has been passed providing for the construction of sidewalks in N. Water st.

Greencastle, Ind.—The construction of bitulithic paving and concrete sidewalks in Seminary st. is contemplated.

Rockford, Ill.—About 6,500 ft. of repaving in State and Main sts. with asphalt or brick is contemplated.

Kansas City, Mo.—Plans for 4 mls. of macadam road in Jackson co. are being prepared by Oscar Koehler, co. engr.

Cambridge, N. Y.—The citizens voted to issue $20,000 for macadamizing Main st. and purchasing a steam road roller.

Arcadia, O.—Plans and specifications have been adopted and the contract will be let in July for brick paving. Vil. coun.

Schenectady, N. Y.—The committee on roads and bridges have approved petitions for paving Wendell, Eastern and Duane aves.

Ashtabula, O.—L. A. Amsden, cy. engr., has been authorized to prepare plans and specifications for grading Perryville ave.

Mason City, Ia.—The city council has ordered 8 blocks of creosoted wood block and 14 blocks of vitrified brick paving.

Pottstown, Pa.—The question of issuing $80,000 bonds for street paving, building sewers, etc., will be submitted to vote.

Fond du Lac, Wis.—Bids will be asked about Aug. 1 for about 1 mi. of asphalt paving in Forest ave. J. E. Hohensee, cy. clk.

Lockport, N. Y.—Plans and estimates have been approved for improving 8.17 mls. of the Lockport-Wendelville road. Bd. supvrs.

Sheboygan, Wis.—Plans are being prepared and bids will be asked soon for 2 mls. of macadam paving, with combined curb and gutter.

Cumberland, Wis.—Will vote July 3 on the question of constructing street improvements and cement sidewalks, at a cost of $6,000.

Asbury, N. J.—Common council has decided to pave Cookman ave. with wood blocks, Bond st. with brick, and Mattison ave. with asphalt.

Red Oak, Ill.—Plans have been prepared and bids will be received soon for 30,000 ft. of cement curb and gutter. C. M. Kelley, cy. clk.

Carrollton, O.—Special.—Plans for 7,000 sq. yds. of paving and 700 ft. of storm sewers have been prepared by F. E. Myers, C. E., of Canton, O.

Des Moines, Ia.—Kingman boulevard, 40th, 41st and 42d sts., will be paved with asphalt and Center st. with brick. Geo. F. Poorman, cy. clk.

Waterloo, Ia.—Final action will be taken July 13 on a resolution to pave W. 5th st., Falls, Sunnyside and Oak Lawn aves, in West Waterloo, with asphalt.

Canal Fulton, O.—Special.—F. E. Myers, C. E., Canton, O., has prepared plans for about 13,000 sq. yds. of paving and 4,484 lin. ft. of sanitary sewer.

Lexington, Mo.—Plans are being prepared by Joseph A. Wilson, cy. engr., for vitrified brick paving on concrete base, in Franklin st. J. Fagert, cy. clk.

Perth Amboy, N. J.—Vitrified brick paving is contemplated for Fayette and State sts. and bitulithic paving for McClellan and Prospect sts. Wilbur La Roe, cy. clk.

Bellingham, Wash.—Resolutions have been passed for paving Commercial and Sylvan sts. and constructing concrete

walks. Petrolithic paving is also contemplated for Donovan ave.

Pasadena, Cal.—City council adopted, June 2, a resolution to pave Los Robles ave. with asphalt, and bids will probably be received about September 1. Heman Dyer, cy clk.

Rockville, Md.—The taxpayers of Potomac district voted, June 17, in favor of issuing $20,000 bonds for the construction of a pike from Potomac to the Conduit road, nearly 5 mis.

Cairo, Ill.—Special.—Plans, specifications and estimates have been completed for paving 34th, 21st, 8th and Walnut sts. and St. Mary's Place, West, with vitrified brick. W. B. Thistlewood, cy. engr.; Stanley A. Miller, asst. cy. engr.

CONTRACTS TO BE LET.

Waukesha, Wis.—Bids are asked until July 3 for macadamizing Hartwell ave. John P. Dey, chmn. B. P. W.

Frankfort, Ind.—Bids are asked until July 7 for constructing 6 gravel roads. Co. comrs.

Tipton, Ind.—Bids are asked until July 6 for constructing gravel roads. J. F. Barlow, co. audt.

Peru, Ind.—Bids are asked until July 8 for constructing 18 gravel roads. Chas. Griswold, co. audt.

Salem, N. J.—Bids are asked until July 6 for constructing 4.76 mis. of road. Josiah Miller, engr.

Decatur, Ind.—Bids are asked until July 6 for constructing macadam roads. C. D. Lewton, co. audt.

Rushville, Ind.—Bids are asked until July 10 for constructing a macadam road. A. L. Winship, co. audt.

Columbus, Ind.—Bids are asked until July 6 for constructing 2½ mis. of road. W. O. Clark, co. audt.

South St. Paul, Minn.—Bids are asked until July 6 for grading River road. John J. O'Brien, cy. recdr.

Little Falls, Minn.—Bids are asked until July 6 for repairing a state road. Peter Virnig, co. comr.

St. Paul, Minn.—Bids are asked until July 6 for improving Bald Eagle Lake ave. Edw. G. Krahmer, co. audt.

Armstrong, Ia.—Bids are asked until July 6 for constructing cement sidewalks. E. R. Stoakes, clk. town coun.

Crawfordsville, Ind.—Bids are asked until July 11 for improving a road in Brown twp. Bennett B. Engle, co. audt.

Bloomington, Ind.—Sealed bids are asked until July 8 for constructing a gravel road. Samuel M. Kerr, co. audt.

Marietta, O.—Bids are asked until July 7 for improving the Marietta-Watertown road. J. M. Williams, co. audt.

Ogden, Utah.—Sealed bids are asked until July 6 for constructing cement sidewalks. A. F. Parker, cy. engr.

Richwood, O.—Bids are asked until July 7 for paving Franklin st. with vitrified brick. Ray L. Jordan, vil. clk.

Jasper, Ind.—Bids are asked until July 7 for constructing 4 mis. of gravel roads. M. A. Sweeney, co. audt.

Lander, Wyo.—Sealed bids are asked until July 14 for grading and surfacing 4,928 ft. of Main st. J. C. Edsall, town engr.

Paoli, Ind.—Bids are asked until July 7 for constructing 13,288 ft. of gravel road in Paoli twp. A. B. Ham, co. audt.

Muncie, Ind.—Sealed bids are asked until July 8 for paving certain public highways with gravel. Jas. E. Davis, co. audt.

Telluride, Col.—Bids are asked until July 11 for constructing and repairing 4½ mis. of road. T. W. Jaycox, state engr.

Cleveland, O.—Bids are asked until July 15 for grading, draining and improving certain roads. Wm. F. Black, clk bd. co. comrs.

Jefferson, O.—Sealed bids are asked until July 9 for macadamizing 2.7 mis. of road in Conneaut twp. J. C. Rodgers, chmn. co. comrs.

Rockville, Ind.—Bids are asked until July 7 for constructing a gravel road in Wabash twp. H. A. Henderson, co. audt.

Chaska, Minn.—Bids are asked until July 6 for constructing cement crossings and cement or brick sidewalks. J. M. Aretz, cy. clk.

Silver Cliff, Col.—Bids are asked until July 3 for constructing and repairing 1 mi. of wagon road. T. W. Jaycox, state engr., Denver.

Vincennes, Ind.—Sealed bids are asked until July 7 for constructing 2,647 ft. of gravel roads in Vincennes twp. John T. Scott, co. audt.

Delphi, Ind.—Bids are asked until July 6 for heavy street grading, cement curb and gutter, sidewalks, etc. W. H. Bradshaw, cy. engr.

Richmond, Ind.—Sealed bids are asked until July 6 for grading, draining, curbing and paving a highway in Wayne twp. D. S. Coe, co. audt.

Cape May, N. J.—Bids are asked until July 7 for constructing a gravel road 2.7 mis. in length. R. Fendall Smith, co. engr., Ocean City.

Ft. Dodge, Ia.—Bids are asked until July 6 for constructing 2,500 ft. of concrete combined curb and gutter. Chas. H. Reynolds, cy. engr.

Crown Point, Ind.—Bids are asked until July 6 for constructing certain gravel roads. Samuel A. Love, chmn. co. comrs.; Chas. A. Johnson, co. audt.

Wapakoneta, O.—Sealed bids are asked until July 7 for grading, graveling and constructing culverts on Montague joint pike. W. H. Myers, co. audt.

Bozeman, Mont.—Sealed bids are asked until 7:30 p. m., July 2, for constructing 25,000 sq. yds. of concrete pavements in Main st. H. H. Holloway, cy. clk.

Mansfield, O.—Sealed bids are asked until July 6 for macadamizing and piking 16,085 ft. of road. J. F. Liston, chmn. bd. trustees, Waller twp., R. F. D. No. 2.

Cincinnati, O.—Bids are asked until July 10 for improving Dick road, in Crosby twp., and Hillside ave., Delhi, Delhi twp. Fred Dreihs, clk. bd. co. comrs.

Rogersville, Pa.—Bids are asked until July 10 for grading 80 to 92 mis. of road and macadamizing about 20 mis. of road. J. R. Randers, secy. pike comrs.

Cheviot (Cincinnati), O.—Sealed bids are asked until July 11 for constructing cement sidewalks in Applegate ave. Chas. Craig, vil. clk., Cheviot Hotel.

Oshkosh, Wis.—Sealed bids are asked until July 13 for macadamizing Vine st. and constructing combined cement curb and gutter. W. A. Marden, chmn. B. P. W.

Washington, D. C.—Sealed bids will be received July 11 for asphalt and asphalt block paving in a large number of streets. H. B. F. MacFarland, chmn. Dist. Comrs.

Clinton, Tenn.—Sealed bids are asked until 1 p. m., July 3, for constructing about 38 mis. of pike road and $5,000 worth of macadam work in this town. J. W. P. Wallace, chmn.

La Jura, Col.—Bids are asked until July 22 for constructing and repairing the wagon road from here to Sandford and from Sandford to Manassa. Luther A. Norland, co. comr.

Racine, Wis.—Bids are asked until July 3 for 27,703 sq. yds. of brick paving, 11,300 ft. of stone curbing, etc., in Washington st. P. H. Connolly, chmn. B. P. W.

Plainfield, N. J.—Bids are asked until July 3 for constructing a macadam road

between this city and Fanwood twp. F. J. Hubbard, co. engr., 201 Park ave.

Ft. Mott, N. J.—Bids are asked until July 17 for constructing an oyster shell road and drain for Flinn's Point National Cemetery here. Capt. J. L. Knowles, constr. Q. M.

Rhinelander, Wis.—Sealed bids are asked until July 7 for constructing macadam road with combined curb and gutter in certain streets, repairing 18,890 sq. yds. of macadam. Geo. C. Jewell, chmn. B. P. W.

Hampton, Ia.—Sealed bids are asked until 8 p. m., July 6, for constructing 15,000 sq. yds. of vitrified brick paving and 4,500 lin. ft. of concrete curb. E. D. Haecker, cy. clk.; C. R. Allen & Son, cons. engrs., Ottumwa.

San Antonio, Tex.—Sealed bids are asked until July 11 for constructing 21,000 sq. yds. of vitrified brick, bitulithic, sheet asphalt and rock asphalt paving and 7,000 lin. ft. of curbing in Houston st. Bryan Callghan, mayor; Fred Fries, cy. clk.

Camden, N. J.—Bids are asked until July 6 for macadamizing 2.4 mls. of section 2 of the Blackwood turnpike, using asphaltum oil for binder, and an alternate bid substituting gravel instead of asphaltum oil for binder on 1½ in. of stone. Alfred L. Sayres, dir. bd. freeholders.

Bentleyville, Pa.—Sealed bids are asked until July 6 for 3,000 sq. yds. of excavation, 3,300 sq. yds. of brick paving, 900 lin. ft. of 12 in. sewer and 300 ft. of 8 in. sewer, and 1 culvert with concrete wing walls. C. C. Hanlon, boro engr., rm. 3, Landefeld Bldg., Monongahela, Pa.

St. Paul, Minn.—Sealed bids are asked until July 13 for improving Sjostedt and Turtle Lake roads. Edw. G. Krahmer, co. audt.

Omaha, Neb.—Sealed bids are asked until July 18 for paving a number of streets and roads. D. M. Haverly, co. clk.

Lawrence, Mass.—Sealed bids are asked until July 8 for 28,000 sq. yds. of wooden block paving. A. D. Marble, cy. engr.

Auburn, N. Y.—Sealed bids are asked until July 7 for paving, curbing and subways in William and Garden sts. J. S. Hanlon, cy. clk.

McKeesport, Pa.—Bids are asked until July 8 for constructing cement walks in East, Park and 6th wards. C. E. Soles, cy. contr.

Wilkesbarre, Pa.—Bids are asked until July 6 for repairs to certain roads. Jas. M. Norris, co. contr.

Palatka, Fla.—Bids are asked until July 21 for constructing 8,500 sq. yds. of granolithic sidewalk. J. E. Craig, cy. engr.

Alliance, O.—Bids are asked until July 3 for grading and paving several streets. C. E. Swearingen, clk. B. P. S.

Martinsville, Ind.—Bids are asked until July 7 for constructing several gravel roads. B. E. Thornburg, co. audt.

St. Louis, Mo.—Bids are asked until July 7 for opening and widening several alleys. W. B. Dryden, secy. B. P. I.

San Antonio, Tex.—Bids are asked until July 11 for constructing 21,000 sq. yds. of vitrified brick, bitulithic, asphalt and rock asphalt paving. Fred Fries, cy. clk.

### CONTRACTS AWARDED.

Cincinnati, O.—Quill & Poos secured the contract for improving Grace ave., for $17,532.

Cherokee, Ia.—The contract for constructing cement cross walks, was awarded to T. D. Campfield.

Shenandoah, Ia.—George F. Cotrill was awarded a contract for brick paving, at $1.83 a sq. yd.

Davenport, Ia.—The McCarthy Improvement Co. and the Davenport Construction Co. secured contracts for paving.

Virginia, Minn.—The contract for constructing 5,000 ft. of sidewalks was awarded to J. P. Rooney, at 45 cts. a ft.

Sigourney, Ia.—The contract for curb and gutter work was awarded to George Carlon & Sons, of Oskaloosa, Ia.

Youngstown, O.—The contract for constructing stone sidewalks was awarded to M. J. Joyce, at 12⅝ cts. a sq. ft.

Avondale, Pa.—The contract for constructing 80,000 sq. ft. of cement sidewalks was awarded to George Filbert, for about $16,000.

Salisbury, N. C.—The American Stone Co. was awarded a contract for 30,000 sq. yds. of granite for making street improvements.

Jacksonville, Ill.—A. F. Franks was awarded a contract for paving S. West and E. College sts. with Purington brick, June 4, for $12,576.

Rochester, N. Y.—The contract for repairs to the West Side boulevard was awarded, June 8, to the Grand Ave. Horse Co., for $36,769.

Springfield, Mo.—The contract for 28,590 sq. yds. of brick paving was awarded to J. C. & E. T. Likes, at $1.71½, $2.74 and 2.32 a sq. yd.

Dunkirk, N. Y.—The contract for paving Dove st. with asphalt on a concrete foundation was awarded to R. C. Ruthven, of this city, for $21,622.

Brooklyn, N. Y.—The Uvalde Asphalt Paving Co. was awarded a contract, June 3, for asphalt paving on concrete base, in 14th ave., for $43,062.

Grand Rapids, Mich.—Klute & Vanderveen secured the contract for improving Lowell ave. for $6,700, with 20 cts. per ft. extra for drain tile.

Ironwood, Mich.—The contract for paving Suffolk and Aurora sts. was awarded to P. McDonnel, of Duluth, Minn., at $1.70 a sq. yd., or $14,510.

Wabash, Ind.—Daniel Showalter & Sons secured the contract for paving Canal st. with brick, at $9.54 for 40-ft. and $7.35 for 30-ft. pavement.

Crawfordsville, Ind.—Scribner & Gardner were awarded the contract for constructing the Jarvis gravel road, in Brown twp., for $6,300.

Chicago, Ill.—The contract for constructing cement sidewalks around the small parks, Nos. 1 and 3, was awarded to Deming & Wendt.

Spokane, Wash.—The contract for grading, curbing, parking and constructing sidewalks in Astor st. was awarded to C. M. Payne & Co., for $9,104.

Columbus, O.—The Indianola Cement Paving Co., of this city, was awarded the contract for constructing cement walks at the Ohio State Fair grounds, for $3,200.

Beacon Falls, Conn.—The contract for macadamizing 8,700 lin. ft. of the River road was awarded to C. W. Blakeslee & Sons, of New Haven, at $1.08½ a lin. ft.

Cairo, Ill.—The contract for constructing fill and sewer in cross streets in the upper portion of this city was awarded to the Cairo Dredging Co., June 4, for $73,819.

Fremont, Neb.—The contract for paving and curbing Dist. No. 14 was awarded to R. Whitfield, of this city, at $1.83 for paving and 39 cts. a lin. ft. for curbing.

Stillwater, Minn.—The Stillwater Stone Sidewalk Co. was awarded the contract for paving several streets in the business section of this city, at $2.05 a sq. yd.

Fort Wood (New York P. O.), N. Y.—The General Contract Co., of New Orleans, La., was awarded the contract for constructing roads and walks here.

Bloomington, Ill.—I. D. Lain was

awarded the contract for constructing brick paving in Jackson st., for $7,333.90, and the Davis-Ewing Concrete Co. the contract for paving an alley, for $388.65.

Hailey, Idaho.—The contract for constructing 3 mls. of cement sidewalks was awarded to Abercrombie & Noddings, of this city, at $1.68 a lin. ft. for 12-ft. walks and 78 cts. a ft. for 6-ft. walks.

St. Paul, Minn.—D. W. Moore was awarded the contract for graveling Snelling ave., for $1,270. The contract for constructing the Rice st. cut-off at Kohler road to the Lake Johanna road was awarded to Nic Ganser, for $2,997.

Niagara Falls, N. Y.—The contract for paving Pine and Cleveland aves. was awarded to Henry P. Burgard, at $2.60 a sq. yd., or $48,121. The contract for paving 22nd st. was awarded to the Read & Coddington Co., for $35,796.

Belleville, Ill.—Contracts for paving and sewers in 5 streets have been awarded as follows: Hoeffken Bros., A st., $24,487; Race st., $7,397; 1st st., $27,053. Reeb Bros., Lebanon ave., $50,988; 2nd st., $15,858.

Perth Amboy, N. J.—The contract for paving Jefferson and Maple sts., with vitrified brick was awarded to Meagher & Smith, for $8,460 and $17,385, respectively. The contract for concreting around the city hall was awarded to Johann Jensen, for $1,976.88.

Gulfport, Miss.—Special.—M. F. Sullivan advises us that the contract for paving, for which bids were submitted May 26, was awarded to the Graves-Mathews Shale Brick Co., of Birmingham, Ala., for $122,536.45.

Louisville, Ky.—The Barber Asphalt Paving Co. has been awarded the contract for reconstructing 3rd ave. with asphalt, with vitrified block gutters, for $10,500. The American Standard Asphalt Co. was awarded the contract for resurfacing Portland ave. with asphalt, for $10,600.

Baltimore, Md.—The General Paving & Contracting Co. has been awarded the contract for paving 30th st., from Charles to St. Paul, with asphalt, for $4,138.50. Warren Brothers Co., of Boston, secured the contract for paving North ave., from Payson to 12th st., with bitulithic, for $136,909.52.

Vicksburg, Miss.—The contract for constructing 24,833 sq. yds. of brick paving in Mulberry and Clay sts. was awarded to the Southern Paving and Construction Co., of Chattanooga, Tenn., at $2.23 a sq. yd. The contract for 8,353 sq. yds. of granite and concrete block paving was awarded to Rudolph S. Blome, of Chicago, Ill., at $2.07 a sq. yd.

Toronto, Ont.—Paving contracts have been awarded as follows: Franklin, Gladstone and Perth aves., Grace st. and Leslie st., from Queen to Doel ave., with bitulithic, for $21,537; Warren Bituminous Co., with bitulithic, Leslie st., from Ivel ave. to Gerrard st., $7,406, and Construction & Paving Co., Emerson ave., with bitulithic, $5,750.

Knoxville, Tenn.—Contracts for approximately 100,000 sq. yds. of street paving have been awarded as follows: Barber Asphalt Paving Co., asphalt, 57,880 sq. yds.; R. S. Blome & Co., of Chicago, granitoid paving, 30,860 sq. yds.; Southern Paving & Construction Co., 4,325 sq. yds. and 3,880 sq. yds. of brick paving; bitulithic paving, Southern Bitulithic Co., 3,825 sq. yds.

Crawfordsville, Ind.—Contracts for constructing cement sidewalks have been awarded as follows: Bridges & Nelson, 5,787.5 sq. ft., in Market sts., 9 cts. a sq. ft.; Clements & Clements, 6,700 sq. ft. of sidewalk and 1,506 lin. ft. of curb and gutter, in John st., 9 cts. a sq. ft. for sidewalk and 42 cts. a lin. ft. for curb and gutter; 1,140 ft. of curb and gutter in Jefferson st., 40 cts. a lin. ft.

Springfield, Ill.—The contract for paving Yale boulevard, in Harvard Park, with brick, with cement curbing and gutters, was awarded to Henry Neich.

Los Angeles, Cal.—The contract for paving Main st., from Jefferson to 37th sts., with asphalt was awarded, June 16, to the Fairchild-Gilmore-Wilton Co., for $22,417.93.

Buffalo, N. Y.—Special.—The contract for paving Gibson st., from Broadway to Stanislaus sts., with asphalt, was awarded to the German Rock Asphalt and Cement Co., for $15,050. This company was also awarded the contract for paving Grey st. for $14,100. The Empire Limestone Co. submitted the lowest bid for furnishing paving stone, crosswalk stone, curbing, sand, gravel and crushed stone for street repairs during the year.

Biddeford, Me.—The contract for paving Elm st. was awarded, June 15, to the Northeastern Paving and Construction Co., at $1.75 a sq. yd.

Hartford, Conn.—Contracts for constructing state roads were awarded, June 15, as follows: 2,509 ft. of telford in town of Plainville, Joseph Mascetti, of Torrington, Conn., $1.95 a lin. ft. for 20-ft. and 45 cts. for 9-ft. width; 5,075 ft. of Berlin pike, McDonald & Hennessey, of Middletown, $5,786; 3,365 ft. in town of Waterbury, O. T. Benedict, Pittsfield, Mass., $6,023; 7,550 ft. in town of Haddam, Roger Kennedy, Middletown, $5,285.

New York City.—The contract for constructing the sidewalks on Blackwell's Island bridge was awarded to the Abbott-Gamble Co., 32 Broadway.

Rochester, N. Y.—C. Lauer & Sons secured the contract for paving Hawley st. with brick for $24,162, and Whitmore, Rauber & Vicinus the contract for paving Huntington st. with asphalt for $6,064.

## SEWERS.

Plainfield, N. J.—A public hearing will be given July 13 on the petition of the North Plainfield council for a contract for joint use of the city's sewage disposal system. The borough desires an agreement for 10 years, but the public affairs committee of this city is in favor of learning the views of the local taxpayers before entering into an agreement.

### CONTEMPLATED WORK.

Rock Hill, S. C.—A sewerage system is contemplated.

Boonville, Ind.—Plans for a sewerage system are being prepared.

Kendallville, Ind.—Plans for a new district sewer are being prepared.

Fayetteville, N. Y.—Plans have been prepared for a sewerage system.

Mellotte, S. D.—The construction of a sewerage system is contemplated.

Albert Lea, Minn.—The question of building a sewerage system is being urged.

Fredonia, N. Y.—A sewage disposal plant will be recommended for this city.

Herkimer, N. Y.—Plans are being prepared for 11,500 ft. of surface sewers.

Newport, Ark.—An ordinance has been passed to establish a sewerage system.

Scalp Level, Pa.—Bids will be asked soon for constructing a new sewerage system.

Prescott, Ark.—The estimated cost of the proposed sewerage system is $30,000.

Flint, Mich.—Council has voted to construct 5 new sewers in the 1st and 5th wards.

Hamburg, N. Y.—Plans for a sewerage system will be prepared by W. J. White, of Buffalo.

La Moure, N. D.—The question of constructing a sewerage system is under consideration.

Cameron, Mo.—Steps may be taken this summer towards constructing a sewerage system.

Burlington, Wis.—Bids will be asked for constructing a sewerage system this year.

Fulton, Ill.—The question of constructing a sewerage system is under consideration.

Park City (Knoxville P. O.), Tenn.—Voted to issue $130,000 for sewer and other improvements.

Marquette, Kans.—The question of installing a sewerage system is still under consideration.

Roseau, Minn.—Council is considering the construction of a 30 and 36-in. sewer in Main st.

Jamestown, N. Y.—An appropriation has been granted for extending the sewer system. Cy. engr.

Warren, R. I.—The question of establishing a sewerage system in East Warren is under discussion.

Aledo, Ill.—An ordinance has been passed providing for the construction of a sewerage system.

New Prague, Minn.—The board of health has recommended the building of a sewerage system at once.

Middletown, N. Y.—Plans will be prepared and bids asked for constructing a sewer in Monhagen ave.

Utica, N. Y.—Bids will be asked soon for constructing trunk sewers in Barnes ave. and Caroline st.

St. Joseph, Mo.—Will vote Aug. 8 on the issue of $250,000 for sewers. Geo. F. Barnes, secy. B. P. W.

Dorrancetown, Pa.—Bids will be asked for soon for constructing a trunk sewer. Harry Brown, boro secy.

Greencastle, Ind.—City council has ordered plans and specifications prepared for a sewerage system.

Springfield, Mass.—An ordinance has been passed for constructing a sewer in Ferry and Cypress sts.

Circleville, O.—The installation of a sewage disposal plant at the Pickaway Co. Infirmary is contemplated.

Wellington, Kans.—Plans for a septic tank for the sewerage system will be made by H. A. Rowland, of McPherson.

Lebanon, Pa.—A resolution has been passed to appoint a special committee to investigate the matter of sewerage.

Albuquerque, N. Mex.—A complete sewerage system will be designed by Samuel M. Gray, C. E., of Providence, R. I.

Columbus, O.—An ordinance has been passed authorizing the construction of the Markeson ave. sewer on the South Side.

Bryan, Tex.—F. D. Perkins, of McKinney, has asked the city council of this city for a franchise to install a sewerage system.

Mt. Vernon, O.—Plans and estimates are being prepared for the construction of a sewerage system by Riggs & Sherman, of Toledo.

Larned, Kans.—Bids will probably be called for about July 10 for constructing 21,000 ft. of laterals. W. P. Peters, cy. clk.

Louisville, O.—Special.—Plans are being prepared for sewers and sewage disposal for this city, by F. E. Myers, C. E., of Canton, O.

Columbus, O.—Plans and specifications have been adopted for constructing a sewer in Sullivant ave., and bids will be asked at once.

Ashtabula, O.—Plans and specifications for constructing sewers in Humphrey and Colorado sts. will be prepared by L. A. Amsden, cy. engr.

Kankakee, Ill.—Estimates for constructing a storm sewer system for the Riverview subdivision will be prepared by the city engineer.

Hastings, Mich.—Surveys, estimates and specifications for a sewer in Michigan ave. and Thorn st. will be prepared by George Burgess.

Ft. Worth, Tex.—This city will vote on the issue of bonds for constructing a sewer system for North Ft. Worth. John F. Grant, mayor.

Batavia, N. Y.—Plans for a system of sewers, to include separate system of storm sewers and a sewage disposal plant, are being prepared.

Carrollton, O.—Special.—Plans for 700 ft. of storm sewers and 7,000 sq. yds. of paving are being prepared by F. E. Myers, C. E., of Canton, O.

El Paso, Tex.—The citizens' committee appointed by Mayor Sweeney to investigate the sewage disposal problem has submitted a report to council.

Quincy, Mass.—The finance committee has passed an ordinance appropriating $30,000 for the extension of main and construction of lateral sewers.

Newark, N. J.—Plans for relieving Orange, Montclair, Bloomfield and Glen Ridge by the disposal of sewage by filtration beds are being investigated.

Canal Fulton, O.—Special.—F. E. Myers, C. E., Canton, O., has prepared plans for about 13,000 sq. yds. of paving and 4,484 lin. ft. of sanitary sewers.

Pittsburg, Pa.—Plans for a reinforced concrete sewage disposal plant at Warner Station, for the City Home, are being prepared by Chapin & Knowles, of this city.

Guthrie, Okla.—The question of issuing $15,000 bonds for building storm water sewers and $10,000 bonds for main sanitary sewers will be voted on. W. W. Miller, cy. engr.

Lawrence, Mass.—An ordinance has been passed appropriating $25,000 for the construction of a brick sewer in the northern part of the city. C. J. Needham, supt. st. dept.

Atchison, Kans.—A resolution has been adopted authorizing the construction of a combined sanitary and storm water sewer system in sewer district "N," about 5 mis. long. Fred Giddings, cy. clk.

Northampton, Mass.—The sewer committee has voted to petition city council for an appropriation of $15,000 with which to construct a sewer from Bay State to Florence.

Newark, N. J.—Julius A. Lebkuecher, of this city, and Wm. S. Ackerman, of Paterson, have gone to Europe for the purpose of visiting English and German towns where sewage disposal plants have been installed.

Carthage, Mo.—A resolution has been passed providing for the construction of a district sewer, with laterals, inlets, catchbasins, manholes, etc., in sewer dist. No. 6. J. P. Leggett, mayor; I. F. Shannon, cy. clk.

Cairo, Ill.—Special.—Stanley A. Miller, asst. cy. engr., says that Wilbur B. Thistlewood, cy. engr., has completed plans and specifications for additional 8 to 30-in. pipe sewers in various streets. The Rich Construction Co., of St. Louis, will shortly resume the construction of 48 to 72-in. concrete main sewers. This work has been delayed on account of high water in the Ohio river.

South Milwaukee, Wis.—This city contemplates engaging engineers to prepare plans for a sewerage system, to be constructed either in connection with or in-

dependent of the present system, and also to render opinion as to the advisability of extending the water works intake. Bids will be received until July 7, and must be accompanied by a complete outline of the proposed plan of procedure. Chmn. W. W. Com.

CONTRACTS TO BE LET.

Pratt, Kans.—Bids are asked until July 24 for constructing a sewer. Cy. clk.

Ellendale, N. D.—Bids are asked until July 6 for constructing a septic tank. John King, cy. audt.

David City, Neb.—Bids are asked until July 8 for constructing a sewerage system. W. S. McCoy, cy. clk.

Corlett, O.—Bids are asked until July 6 for constructing sewers in 7 streets. W. H. Jantzen, vil. clk.

Cleveland Heights, O.—Bids are asked until July 7 for establishing grade and constructing a sewer in parts of Compton and Highland roads. Wm. G. Phare, vil. clk., 204 Am. Trust Bldg., Cleveland.

Wabash, Ind.—Bids are asked until July 13 for constructing a brick sewer in Cass st. Fremont McLees, cy. clk.

Plymouth, Wis.—Bids will be received about Aug. 1 for constructing 5,000 ft. of sewer. C. W. Jackson, cy. clk.

Muscatine, Ia.—Sealed bids are asked until July 6 for constructing 1½ mis. of ditch. A. S. Lawrence, co. audt.

Pierce, Ill.—Bids are asked until July 3 for digging 2¾ mis. of open ditch. A. J. Cofey, clk. drainage comrs.

Alameda, Cal.—Bids are asked, according to press reports, until July 6, for constructing several sewers. Cy. coun.

Andalusia, Ala.—Sealed bids are asked until July 10 for installing a sewerage system. Z. D. Studstill, town clk.

Shelby, N. C.—Bids are asked until July 22 for constructing sewerage and water works systems. J. F. Riddy, cy. clk.

Trenton, N. J.—Sealed bids are asked until July 7 for constructing a sewer in Hill's alley. Harry B. Salter, cy. clk.

Fond du Lac, Wis.—Bids are asked until Aug. 1 for constructing a concrete storm sewer in Park ave. J. F. Hohensee, cy. clk.

Plainfield, N. J.—Bids are asked until July 6 for constructing sanitary sewers. Andrew J. Gavett, cy. engr.; Jas. T. MacMurray, cy. clk.

Springfield, O.—Sealed bids are asked until July 3 for constructing sanitary sewers in Main and Plum sts. Wm. H. Mahoney, clk. B. P. S.

Washington, D. C.—Bids are asked until July 6 for furnishing culvert pipe. Lieut. Col. H. F. Hodges, genl. purchasing officer Isthmian Canal Comm.

Omaha, Neb.—Bids are asked until July 6 for constructing brick or concrete and storm water sewers in Izard and Jones sts. Andrew Rosewater, cy. engr.

Newark, N. Y.—Bids are asked until July 7 for constructing a sewage disposal plant. Benj. B. Chase, secy. bd. mgrs. of N. Y. State Custodial Asylum.

Valley City, N. D.—Sealed bids are asked until July 6 (readvertisement) for constructing a 10-in. sewer in Elizabeth st. H. F. Halverson, cy. audt.

Bentleyville, Pa.—Bids are asked until July 6 for constructing 900 ft. of 12-in. and 300 ft. of 8-in. tile sewer and 1 concrete culvert. C. C. Hanlon, boro engr.

Eureka, Cal.—Bids are asked until July 6 for constructing an 8-in. salt-glazed vitrified ironstone sewer, with 96 4-in. Y branches in Mound st. F. E. Browning, cy. clk.

Rockwell City, Ia.—Bids are asked until July 8 for constructing about 19,800 ft. of 24, 22, 20, 18, 16, 14, 12, 10 and 8-in. drain tile. B. E. Stonebaker, co. audt.

Chicago, Ill.—Sealed bids are asked until July 8 for furnishing centrifugal pumps, induction motors, high-pressure pumping unit, lead-covered cable, etc. Robert R. McCormick, prest. bd. trustees.

Shelbyville, Ind.—Bids are asked until July 7 from engineers for furnishing plans, specifications, estimates, and for the supervision of a storm water and sanitary sewer system. H. J. Clark, cy. clk.

Thompsonville, Conn.—Sealed bids are asked until July 7 for constructing 3,500 ft. of sewer, with 2 flush tanks and 10 manholes. The pipe must be of first-class Akron or Ohio River vitrified granite pipe. M. W. Bushnell, sec'y-treas. bd. sewer comrs., Dist. 2, Enfield.

Portsmouth, Va.—Sealed bids are asked until July 28 for constructing a sanitary sewer system for the 5th ward. Bascom Sykes, cy. engr.

Mobile, Ala.—Bids are asked until July 13 for constructing storm sewers. Wright Smith, ch. engr. B. P. W.

Wadsworth, O.—Bids are asked until July 6 for constructing a sewage disposal plant. Louis F. Allen, vil. clk.

St. Bernard (Cincinnati P. O.), O.—Bids are asked until July 2 for constructing a sewer in Carthage pike. Geo. Schroeder, vil. clk.

Springfield, O.—Bids are asked until July 3 for constructing sewers in various streets and avenues. Wm. H. Mahoney, clk. B. P. S.

St. Paul, Minn.—Bids are asked until July 2 for constructing an outlet sewer for the 9th ward. B. P. W.

CONTRACTS AWARDED.

River Rouge, Mich.—The contract for constructing 18 mis. of sewers was awarded to Ferd Porath, of Detroit.

Austin, Minn.—The contract for constructing sewers was awarded to H. S. Thill, of La Crosse, Wis., for $9,800.

Atchison, Kans.—The contract for constructing sewers in dist. Z was awarded to P. W. Barnett, of this city, for $2,533.

Wheeling, W. Va.—The contract for furnishing sewer pipe during the year was awarded to the Wheeling Wall Plaster Co.

Salt Lake City, Utah.—The contract for constructing sewer extension No. 186 was awarded Davis & Heuser, for $54,506.92.

Foxcroft, Me.—Hartwell & Blanchard, of Old Town, Me., secured the contract for the continuation of the sewerage system.

Bloomington, Ind.—The contract for constructing an 11-mi. sewerage system here was awarded to W. H. Harris, of Terre Haute.

Merchantville, Pa.—The contract for completing the sewerage system was awarded to B. F. Sweeten & Son, of Camden, for $57,300.

Ames, Ia.—The contract for constructing sewers in the 4th ward was awarded to R. C. De La Hunt, of Marshalltown, for $23,177.37.

Knoxville, Tenn.—The contract for the extension of the First Creek main sewer was awarded, June 18, to John L. O'Connor, for $11,820.

Welland, Ont.—John Connolly, of Toronto, Ont., was awarded the contract for constructing sewers in the North ward, for $15,000.

Rochester, Minn.—The contract for constructing sewers in the 8th st. dist. and St. Mary's road was awarded to the Fraser-Elliott Co., for $4,987.

Hamilton, O.—Joseph T. Guillaume, of this city, was awarded the contract for constructing the third section of Crawford's Run sewer, for $46,800.

Iron Mountain, Mich.—J. R. Holfeltz, of this city, was awarded the contract for constructing the extension to the main sewer in Kimberly ave., for $13,800.

St. Joseph, Mo.—John Marnell was awarded the contract for constructing a sewer in dist. No. 63, and the Hartman Bridge & Construction Co. the contract for a sewer in dist. No. 59.

Baltimore, Md.—The contract for constructing a diversion sewer in connection with the high service reservoir near Forest Park was awarded to C. B. Clark & Co., of this city, for $33,572.

Gallitzin, Pa.—The contracts for constructing sewers were awarded to James K. Malone, of Hollidaysburg, Pa., for $3,997 for the vitrified clay section and $3,913 for the concrete section.

Cairo, Ill.—Special.—The contract for constructing 12 to 20-in. sewers and fill in streets by hydraulic process was awarded, June 4, to the Cairo Contracting and Dredging Co., of this city, for about $73,000. W. B. Thistlewood, cy. engr.

Sioux City, Ia.—The contract for constructing 750 ft. of pipe sewer and manholes in Ingleside ave. was awarded to John McGraw, at 55 cts. a ft. and $35.70 each for manholes. The contract for constructing a storm sewer at 1st and Main sts was awarded to L. Christianson & Co., at $5 a foot.

Washington, D. C.—The Lynchburg Foundry Co., of Lynchburg, Va., was awarded the contract for furnishing sewer pipe for the District, as follows: For c. i. sewer pipe—Five tons of 3-in., $29.44; 34 tons of 4-in., $26.44; 40 tons of 6-in., $25.44; 922 tons of 8-in., $24.94; 433 tons of 12-in., $24.94.

Freeport, Ill.—The contract for constructing sewers was awarded, June 3, to M. F. Ord, of Cedar Rapids, Ia., as follows: 5,540 lin. ft. 24-in. pipe sewer, $3.08; 4,400 lin. ft. 18-in. pipe sewer, $1.95; 4,910 lin. ft. 12-in. pipe sewer, $1.15; 20,790 lin. ft. 8-in. pipe sewer, 85 cts.; 103 manholes, each, $22; total, $42,831.

Livermore, Cal.—The contract for constructing sewers was awarded, June 1, to N. Clark & Sons, as follows: 1,140 ft. 12-in. vitr. sewer pipe, 36 cts.; 2,600 ft. 10-in., 26 cts.; 9,350 ft. 8-in., 20 cts.; 42,930 ft. 6-in., 13¼ cts.; 40 of 10-in. Y branches, 94 cts.; 180 of 8-in., 80 cts., and 1,160 of 6-in., 52 cts. Phoenix Iron Wks., of Oakland, secured contract for 109 manhole frames and covers at $8 each.

Gulfport, Miss.—Special.—The contract for constructing storm water sewers was awarded, May 26, to J. W. Gurley & Co., of Mobile, Ala., for $15,836.90, as follows: 15,190 ft. 24 to 8-in. pipe sewer, $1.97 to 19½ cts. per lin. ft., 23 manholes, $35 to $43 each, according to depth; 36 catchbasins, each, $29, etc.; total, $15,837. Totals of other bids: Irwin Bros., New Orleans, La., $17,756; C. M. Burkhalter, Birmingham, Ala., $19,257, and Pouncy Paving & Constr. Co., Helena, Ark., $26,215.

Gas City, Ind.—The contract for constructing a sewer was awarded to the Gas City Construction Co., for $15,261.52.

San Francisco, Cal.—The contract for constructing a reinforced concrete sewer in Commercial st. was awarded to the Healy-Tibbitts Construction Co., 268 Market st., for $26,779, and in California and Sacramento sts. for $9,958. O. I. McHugh was awarded the contract for constructing a sewer in Fulton st. for $11,649.

Welland, Ont.—The contract for building sewers in the North ward was awarded to John Connolly, of Toronto, for about $15,000.

## WATER WORKS.

### CONTEMPLATED WORK.

Alden, Minn.—Voted to issue $5,000 water-works bonds.

Shattuck, Okla.—A water-works system is contemplated.

Bennettsville, S. C.—A water-works system will be installed.

Platte, S. D.—A water-works system is contemplated.

Oak Park, Ill.—A new water-works system will be built here.

Sallisaw, Okla.—Voted to issue bonds for constructing water-works.

Havensville, Kas.—Voted to issue bonds for a water-works system.

St. Henry, O.—A water-works system is contemplated. Wm. H. Romer, cy. clk.

Charter Oak, Ia.—The town council will erect a concrete water tank and reservoir.

Monroe, Neb.—Voted to issue bonds for constructing water-works system.

Shawnee, O.—Voted to issue $25,000 bonds for constructing a water-works system.

Baldwin, Kas.—The question of constructing a water-works system will be voted on.

Holly, Colo.—Voted to issue bonds for the construction of a water-works system.

Cumberland, Wis.—The extension of the water mains is proposed.

Harrisonville, Mo.—The question of constructing a water-works system is being discussed.

Laurium, Mich.—The construction of a municipal water-works system is contemplated.

Knox, Ind.—Plans are being prepared for a water-works system by Geo. C. Morgan, of Chicago.

Minot, S. D.—Voted to issue $30,000 for constructing a municipal water-works system.

Nowata, Ok.—Voted to issue $65,000 bonds for the purpose of installing a water-works system.

Grand Rapids, Minn.—The cost of a water-works system is being investigated by a committee.

Ellendale, N. D.—Will vote July 6 on the issue of $6,000 bonds for a half-inch artesian well.

Bloomington, Wis.—Will vote July 6 on the issue of $13,000 bonds for constructing water-works.

Columbus Junction, Ia.—Will vote July 6 on the issue of $40,000 bonds for renewing the water tank.

Gadsden, Ala.—The question of issuing bonds for constructing a water-works system will be voted on.

Fullerton, Cal.—The question of issuing $40,000 bonds for installing a water-works system will be voted on.

Kingsland, N. J.—An ordinance has passed first reading for the extension of the water system.

Tarentum, Pa.—This city voted June 17 to issue $100,000 bonds for the erection of a municipal water plant.

Virginia, Ill.—The Business Mens' Association is interested in the question of constructing a water-works system.

Winchester, Ill.—Jas. H. Thompson, of Chicago, has been appointed engineer for the new water-works system to be constructed here.

De Queen, Ark.—An ordinance is being considered for the formation of an improvement district to install a water-works system.

Bradford, Pa.—Bids will soon be asked for constructing a 550-mi. line from this city to Robinson, by the Tidewater Pipe Line Co.

Vallejo, Cal.—Voted to issue $70,000

bonds for constructing a reservoir and bids will be received during July. W. J. Torney, cy. clk.

Milltown, Ga.—Mayor Talley has appointed councilmen W. L. Black and Geo. B. Murrell to ascertain the cost of constructing a water-works system.

Towner, N. D.—Plans have been completed for the construction of 1-mi. of mains, 100-ft. steel tower with tank and a gasoline pumping engine.

Oswego, N. Y.—Plans have been completed and bids will soon be asked for constructing a pump house on the lake shore in connection with the lake water plant.

Elm Grove, W. Va.—James A. Birkett has asked for permission to construct a water-works system to supply all towns and cities between this city and Fulton, W. Va., with water.

Rock Rapids, Ia.—The water-works franchise of this city expires in about 3-yrs. and council is taking preliminary steps to either purchase the present plant or install a new one.

Sioux City, Ia.—The suburb of Leeds has asked the city council of this city to call a special election to decide whether or not a water-works franchise shall be granted to Leeds for an independent plant.

Baltimore, Md.—Mayor Mahool has been empowered to employ two experts to study the plans prepared by water engineer Quick for a reservoir. The fire board will expend $465,000 for constructing a pipe line in the central portion of the city.

### CONTRACTS TO BE LET.

Houston, Tex.—Bids are asked until July 27 for erecting a pumping engine, with plans, etc. H. B. Rice, mayor.

Templeton, Ia.—Sealed bids are asked until July 20 for constructing a water-works system. M. J. Daeges, town clk.

Ottawa, Ont.—Bids are asked until July 8 for constructing a movable dam. Fred Gelinas, secy. dept. pub. wks.

Ricketts, Ia.—Sealed bids are asked until July 6 for constructing a water-works system. J. C. Jacobson, mayor.

Atlanta, Ga.—Bids are asked until July 6 for furnishing water-tube boilers. Park Woodward, genl. mgr. water bd.

Carrington, N. D.—Sealed bids are asked until July 6 for furnishing and laying water mains. E. I. Walton, mayor.

Cherokee, Ia.—Bids are asked until July 7 for extensions to the water-works system. Wm. Shardlow, Jr., cy. clk.

Reading, Pa.—Bids are asked until July 10 for constructing Bernhart filters. Lincoln S. Ramsey, secy. bd. water coms.

Gibbon, Minn.—Bids are asked until July 6 for painting the water tanks and tower. John E. Peterson, vil. recdr.

Seattle, Wash.—Bids are asked until July 11 for the second unit of the Cedar River water supply system. R. H. Thomson, cy. engr.

Sturgeon Bay, Wis.—Sealed bids are asked until July 7 for constructing a water-works and electric light plant. H. C. Leonhardt, cy. clk.

Cincinnati, O.—Bids are asked until July 13 for the sale of boilers, pumping engines, deep well pumps, etc. John J. Wenner, clk. B. P. S.

Concord, Mass.—Sealed bids are asked until July 8 for laying c. i. pipe and appurtenances and building a reservoir. Wm. Wheeler, chmn. water-sewer comrs.

Victoria, Wash.—Bids are asked until July 20 for supplying and erecting a pumping engine, steel tank and tower and concrete tank and steel water tower.

Boston, Mass.—Sealed bids are asked until July 6 for furnishing and installing piping at the lock in the Charles river dam. Henry D. Yerxa, chmn. Charles River Basin Comn.

Batavia, Ill.—Sealed bids are asked until July 6 for constructing 17,019-ft. of 4-in. and 860-ft. of 6-in. c. i. water main; 18 hydrants; valves and valve boxes. Water Comn.

Boston, Mass.—Sealed bids are asked until July 7 for constructing 5 timber submerged outlets for the Boston Marginal Conduit. Henry D. Yerxa, chmn. Charles River Basin Comn.

Toledo, O.—Sealed bids are asked until July 7 for constructing 2-mis. of concrete conduit from the new filtration plant to the water-works station. Reynold Voit, secy. B. P. S.

Chicago, Ill.—Bids are asked until July 8 for furnishing centrifugal pumps, induction motors, high-pressure unit and lead-covered cable. R. R. McCormick, prest. sanitary dist.

Cleveland Heights, O.—Bids are asked until July 7 for establishing grade and laying 6-in. water mains in parts of Compton road, Highland road and Euclid boulevard. Wm. G. Phare, vil. clk.

New Boston, Ill.—Bids are asked until July 29 for erecting a pumping plant and sluiceways, including water tube boilers, 3 engines and 3 centrifugal pumps. Comrs. of Bay Island Drainage & Levee Dist. No. 1.

Avila (Port Harford P. O.), Cal.—Bids are asked until July 7 for a franchise of 50-yrs. to construct, lay, erect, maintain and operate public pipe lines, for furnishing and supplying water. H. H. Carpenter, clk. bd. supvrs.

Manchester, Mass.—Bids are asked until July 10 for furnishing and delivering about 443-tons of 16-in. straight bell and spigot coated c. i. pipe, 523-tons, 14-in. pipe and 12-tons of special castings. Frederick J. Merrill, chmn. comrs.

Cincinnati, O.—Sealed bids are asked until July 13 for the sale of boilers, pumping engines, deep well pumps, boiler feed pumps, hoisting engines, horizontal engines, tools, etc., at certain pumping stations. John J. Wenner, clk. B. P. S.

Orland, Cal.—Bids are asked until Aug. 27 for constructing the East Park dam, spillway and dikes, located about 12-mis. northwest of Sites, and involving the placing of about 13,500-cu. yds. of concrete and exca. U. S. Reclamation Service, Orland.

Los Angeles, Cal.—Bids are asked until July 27 (extension of time from July 17), for constructing the Jawbone division of the Los Angeles Aqueduct, including about 43,000,-lin. ft. of lined tunnel, 60,000-lin. ft. of lined conduit and 340-cu. yds. of exca. H. B. Ferris, secy. B. P. W.

Toledo, O.—Sealed bids are asked until July 7 for contr. No. 10 for the improvement of the water supply as follows: 1st—constructing concrete intake pier; 2nd—furnishing and laying 780-ft. of 48-in. submerged intake pier, etc.; 3rd—constructing brick gate house on top of intake pier. G. W. Tonson, prest. B. P. S.

### CONTRACTS AWARDED.

Portland, Ore.—Caldwell Bros., of Seattle, Wash., secured the contract for water valves, at $3,410.

Two Rivers, Wis.—The contract for constructing 1,100-ft. of water mains was awarded to Walter O. Bahr.

Sweetwater, Tenn.—The contract for constructing a water-works system was awarded, June 9, to Guild & Co., Chattanooga.

Velva, N. D.—The contract for constructing a water-works system was warded to C. H. Porritt, of Fargo, N. D., for $25,000.

Milwaukee, Wis.—The contract for constructing the north wing of the North Point pumping station was awarded to Frank Niezorawski, for $12,850.

Baltic, Conn.—The contract for constructing 2 reservoir dams was awarded to the Ambursen Hydraulic Construction Co., 176 Federal st., Boston.

Rome, N. Y.—The contract for constructing the pipe line for the new waterworks system was awarded to Chas. Miller & Sons' Co., of Utica, for about $97,541.

Baltimore, Md.—The contract for building the high service reservoir near Forest Park was awarded to Lane Bros. & Jones, of this city, June 15, for $494,810.20.

Dallas, Tex.—The contract for constructing the pumping station, including an engine room, pumping engine, etc., was awarded to the Hughes O'Rourke Co., for $27,777.

Grand Rapids, Mich.—The contract for laying water pipe in Cherry alley and other streets was awarded to Van der Veen & Messell, for $1,250.20; in 11th and other streets, Thos. P. McDermott, $2,-117.60.

Salt Lake City, Utah—Special. Louis C. Kelsey, cy. engr., says that the contract for constructing water mains during 1908 was awarded June 5 to J. D. Hanley, of this city, for $34,404.50.

Buffalo, N. Y.—Special. The contract for constructing a steel water tank at Kensington ave. and Grider st. was award-June 16 to the Reeves Brothers' Co. for $12,150. The B. I. Crooker Co. secured the contract for constructing a tower to surround the tank for $38,300.

Wyncote, Wyo.—The contract for furnishing cast iron gates, lifting devices, etc., for use in connection with the Interstate canal, North Platte irrigation project, Nebraska-Wyoming, was awarded to the Colorado Gray Iron Foundry Co., of Denver, Colo., for $3,498.

Kimberley, Nev.—Contracts for installing a water supply system here were awarded June 18 by the Goroux Consolidated Mines Co., 42 Broadway, N. Y. City, as follows: For two Class "A" No. 14 Stirling boilers to the Babcock & Wilcox Co., 85 Liberty Co., New York, at $8,565; one crank and fly-wheel high-duty pumping engine, 500,000 gallons capacity, one triple-expansion pumping engine, 500,000 gallons capacity, to the Epping-Carpenter Co., 41st st., Pittsburg, Pa., at $10,500 and $7,500, respectively; 25,000-ft. 8-in. steel pipe ⅜-in. thick, to the National Tube Co., 30 Church st., New York, at $1.4085 per ft.; 6,000-ft. of No. 12, 26,000-ft. of No. 14, 13,000-ft. of No. 16 spiral riveted 8-in. pipe, to the American Spiral Pipe Co., 50 Church st., New York, at 86, 66 and 56½ cts. per ft.; for the construction of the pipe line and reservoir, to the American Light & Water Co., Los Angeles, Cal., at $40,451.

## BRIDGES.

Portsmouth, O.—Bids are asked until July 15 and 22 for building bridges. Co. comrs.

Emerson, Ind.—Bids are asked until July 7 for constructing a bridge here.

Albion, Mich.—This city voted to issue $40,000 bonds for building bridges.

Easton, Pa.—Bids are asked until July 3 for repairing bridges. L. A. Francisco, co. engr.

Coshocton, O.—Bids are asked until July 8 for constructing 2 bridges. Geo. J. Buck, co. surv.

Fargo, N. D.—Bids are asked until July 14 for constructing various bridges. Arthur G. Lewis, co. audt.

Oregon, Mo.—Bids are asked until July 7 for building 2 bridges. Wm. E. Morris, co. highway engr.

Jasper, Ind.—Sealed bids are asked until July 7 for constructing 4 iron bridges. M. A. Sweeney, co. audt.

Anderson, Ind.—Bids are asked until July 9 for constructing several bridges. W. T. Richards, co. audt.

Logan, O.—Bids are asked until July 10 for constructing a concrete arch bridge. Jas. Bebout, co. audt.

Indianapolis, Ind.—Bids are asked until July 3 for constructing several bridges. Albert Sahm, co. audt.

Ft. Atkinson, Wis.—Will vote July 7 on the issue of $25,000 bonds for constructing a new bridge across Rock river.

Ottawa, Ill.—Estimates have been submitted to the city council of the cost of building a bridge over Illinois river.

Dayton, O.—Bids are asked until July 18 for constructing the Dayton View bridge. Fred J. Allaring, cy. engr.

Walhalla, S. C.—Bids are asked until July 7 for constructing an iron bridge over Little river. D. F. McAllister, co. supvr.

Kentland, Ind.—Bids are asked until July 6 for constructing steel bridges with concrete abutments. A. E. Purkey, co. audt.

Landor, Wyo.—Bids are asked until July 14 for constructing a concrete arch and 2 concrete culverts. J. C. Edsall, town engr.

Frederickton, N. B.—Bids are asked until July 20 for constructing 3 metal highway bridges. John Morrissey, chmn. dept. pub. wks.

Lewiston, Idaho—Bids are asked until July 14 for constructing a bridge over Lawyers' Canyon. W. L. Clifford, clk. co. comrs.

Rochester, Ind.—Bids are asked until July 8 for constructing a steel and wrought iron bridge over Tippecanoe river. Separate bids are asked for constructing concrete abutments for the bridges. Geo. W. DuBois, co. audt.

Max Meadows, Va.—Bids are asked until July 6 for constructing an iron bridge over Reed Creek. J. H. McGavoch, chmn. co. supvrs.

Garberville, Cal.—Bids are asked until July 8 for constructing a steel highway bridge over Eel river. Geo. W. Cousins, co. clk.

Marshall, Mo.—Plans are being prepared for a concrete and steel bridge and a number of concrete culverts. Wm. J. Durrett, co. clk.

Hartford, Conn.—Bids are asked until July 6 for the repair of the Boulevard bridge across Park river. Jas. P. Berry, secy. bd. contr. and sup.

Maryville, Mo.—The construction of 100 small steel or reinforced concrete bridges and culverts is contemplated. Geo. De Mott, co. clk.

Durant, Ok.—Bids are asked until July 9 for constructing a suspension bridge over Island Bayou, near here. J. M. Abbott, chmn. bd. comrs.

Bayonne, N. J.—The contract for building a bridge over Morris canal at Avenue C was awarded to John F. Murphy, of West Hoboken, for $13,280.

Cincinnati, O.—Sealed bids are asked until July 3 for the repair of a bridge over Taylor's Creek at Fowler's Crossing. Stanley Struble, prest. co. comrs.

La Porte, Ind.—Bids are asked until July 6 for constructing a bridge with concrete abutments over the Kankakee river at Riverside. Co. comrs.

Middletown, O.—Sealed bids are asked